VOLUME IV

# TRANSCRIPT OF RECORD

## Supreme Court of the United States

OCTOBER TERM, 1965

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No. 462

WASHINGTON PUBLIC POWER SUPPLY SYSTEM, PETITIONER,

vs.

FEDERAL POWER COMMISSION, ET AL.

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No. 463

STEWART L. UDALL, SECRETARY OF THE INTERIOR, PETITIONER,

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ON WRITS OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA CIRCUIT

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**BEFORE THE**

**FEDERAL POWER COMMISSION**

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Project No. 2243

In the Matter of

PACIFIC NORTHWEST POWER COMPANY

Project No. 2273

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

---

Held at Washington, D. C.

[fol. 4]

**Transcript of Proceedings—November 4, 1960**

Presiding Examiner: The hearing will come to order in the matter of Pacific Northwest Power Company, Project No. 2243, and Washington Public Power Supply System, Project No. 2273.

* * * * * * *

[fol. 33]

OPENING STATEMENT ON BEHALF OF WASHINGTON PUBLIC POWER SUPPLY SYSTEM, BY MRS. COOPER

Mrs. Cooper: Mr. Examiner, at stake in this proceeding, basically, is the future of the economy of the Pacific Northwest. That region suffered a severe loss of its water resources as a result of the decision of the Federal Power Commission in the Hells Canyon Case. The filing made here by Washington Public Power Supply System—a public body with a public responsibility—was for the purpose, sir, of assuring that the region of the Northwest not suffer a similar loss again. The economy of the Pacific Northwest in terms of industrial development has been at a

standstill for the last seven or eight years. That was one of the consequences of the Hells Canyon decision. We are determined to do everything that is within our power to see that the economy of the Northwest begins to move again; that industrial development is renewed in the Northwest again.

That is impossible, sir, without a new large block of low-cost power.

For all of Mr. Smith's vaunting of the Mountain Sheep-Lower Canyon combination, the fact remains that the Lower Canyon Dam is a paper dam. No one is proposing to build it. As a matter of fact, the company says it should not [fol. 34] be built until after the fish passage problem is solved. The fish people say the fish passage problem on the Salmon River can not be solved, and they propose to do nothing to try to find a solution.

What the Pacific Northwest Power Company is proposing, therefore, is that the region of the Northwest forego once again full development of the only great natural resource it has—the Columbia River and its tributaries. That, sir, is why we as a public body, mindful of our public responsibility, are here in this proceeding.

I think it is important to correct the record as it was represented to you by Mr. Smith. In the first place, as you yourself stated, this proceeding began with the filing of the company's application for a license to build High Mountain Sheep in March of 1958. This proceeding did not begin in 1955. The Mountain Sheep-Pleasant Valley case, which began in that year, was disposed of by the Commission in 1957. It is dead, it is behind us, it can not be resurrected.

With its demise went the original preliminary permit of the Pacific Northwest Power Company for investigation of the Mountain Sheep-Pleasant Valley sites. That preliminary permit did not survive the filing of a license for Mountain Sheep-Pleasant Valley, let alone survive the decision of the Commission denying a license.

Mr. Smith would have you believe that there is unanimity [fol. 35] among the technical agencies that have looked at the Columbia River with respect to their position on Nez Perce versus Mountain Sheep and Lower Canyon. That is not so. The only technical agency that has arrived at the conclusion represented by Mr. Smith is the Oregon State Water Resources Board, and it is doubtful that that board even had before it at the time it arrived at a decision, a political decision, being an arm of the State of Oregon in which Pacific Northwest Power Company has its locus and not divorced from influencing pressure of the component companies of Pacific Northwest Power Company located in the State of Oregon.

But it is apparent from the record, as it stands now, that when that state agency reached the conclusion it did, it did not have before it the Nez Perce project which we are now proposing.

Furthermore, the Corps of Army Engineers has repeatedly held that the Nez Perce project is the most superior project that could be built in all of the Columbia River Basin south of the Canadian border. It did not repudiate that conclusion in its current report. Indeed, it confirmed it.

Similarly, the Commission, in rejecting the company's earlier application for a license to build Mountain Sheep and Pleasant Valley, arrived at the conclusion that no combination of dams for this stretch of the Snake River could be built that would satisfy the licensing standard of compre- [fol. 36] hensive development that did not include Nez Perce.

In that same decision, contrary to Mr. Smith's representation, the Commission held that the fish passage problem at Nez Perce was solvable. And if you examine the record, sir, you will find that that decision rested on a statement that was made on this very witness stand by the head of the U.S. Fish and Wildlife Services regional office, located in Seattle, in which he said, and I quote him almost

verbatim, that if confronted with the fact of a license having been issued for Nez Perce, or Nez Perce having been authorized by the Congress, a solution for the fish passage problem would be found.

It is apparent from what I have said, from what Mr. Smith has said, that this controversy over full development versus less than full development of the great water resources of the Pacific Northwest, has been one of great public concern over the last several years. And it is also true that the public power, the non-profit utility systems in the Northwest—of which there are many—as well as many of the citizens groups, public groups in the Northwest, have been actively concerned in this matter.

It is for that reason that they waged the fight they did against Idaho Power Company's three small dams. It was for that reason that they intervened again in opposition to Pacific Northwest Power Company's Mountain Sheep-[fol. 37] Pleasant Valley proposal. It was for that reason also that they intervened in opposition to the company's filing for High Mountain Sheep. However, it became apparent that without a major effort being made, which the fish agency weren't doing, nobody else was doing—to find a solution for the fish passage problem—Mr. Smith, we can do without your pencil tapping, if you please—that unless an effort was made to find a solution to the fish passage problem, the Salmon River might be lost to the High Mountain Sheep development.

It was for that reason that these public groups, including the public power agencies in the Northwest, proposed to the Congress that a five-year moratorium be established within which the fish problem might be solved and the fisheries' agencies given an appropriation which they had not themselves asked for to finance a crash program that would find a solution to the fish passage problem.

In the meantime, however, pressures were being built up on the Federal Power Commission to begin a hearing immediately. This was in the early spring of this year, in

February—to begin a hearing immediately on the company's High Mountain Sheep application, notwithstanding the fact that the company had let its application languish without readying it for hearing for a period of two full years.

Finally, faced with that kind of pressure, and a situation in which it seemed inevitable that a license would be issued [fol. 38] for High Mountain Sheep, in view of the background and the buildup, if a competitive application were not filed, because the public power groups in the Northwest did not feel the region nor they could afford to see Nez Perce sacrificed to High Mountain Sheep, it was then that a herculean effort was undertaken and the Nez Perce application was filed. The effort since then has been continually of a herculean nature. It is a credit to the public power agencies in the Northwest, and that includes the whole of the region, for there are 55 of them—co-ops, municipals, countywide, public utility districts—who are engaged in this effort, that within less than four months' time the Nez Perce project was thoroughly engineered and some 400 pages of testimony from the very best experts that could be found from around the country was put together and filed with the Federal Power Commission. That took no little doing, sir, and the effort has been continuingly intense ever since. It will remain so.

We are in here to see to it that the Nez Perce project is licensed, and we intend to take every step that is necessary to that end, including whatever procedural steps we feel in all good faith and honesty are necessary to protect our position. That is our one and only motivation and objective.

* * * * * * *

[fol. 46] These issues of the eligibility of PNPC as a licensee, we submit, are insurmountable. Over and above these issues, overriding all of them, Mr. Examiner—and I say this in all seriousness—in my judgment is the question as to whether or not the administrative process will survive

if we have in this case another case of administrative agency amendment of the Federal Power Act violating, vitiating, the intent, the will of the Congress, to see that the public interests are served.

• • • • • • • •

[fol. 70] Q. Would you read the program and order into the record?

A. "BEFORE THE STATE WATER RESOURCES BOARD OF THE STATE OF OREGON

Middle Snake
River Basin

March 5, 1960

"In the matter of formulating an integrated, coordinated program for the use and control of the water resources of the Middle Snake River

"WHEREAS the State Water Resources Board under the authority of ORS 536.300 has undertaken a study of that portion of the Snake River from river mile 176.0 to river mile 247.0;

"WHEREAS in this study consideration was given to means and methods of augmenting such water resources, existing and contemplated needs and uses of water for domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife and fish life uses, and for pollution abatement as well as other related subjects including drainage, reclamation, and flood control; and

[fol. 71] "WHEREAS, as a result of said study the following findings as to water use have been reached by this Board:

1. Recreation uses will bring substantial benefits to the state.

2. Fish and wildlife uses will bring substantial benefits to the state.

3. Hydroelectric power production utilizing the waters of the Snake River and its tributaries between river mile 176.0 and river mile 247.0 will bring substantial benefits to the state.

4. Domestic use does not represent a significant quantity either for existing or presently contemplated needs.

5. Mining use does not represent a significant quantity either for existing or presently contemplated needs.

6. Municipal use is not a significant factor for either existing or presently contemplated needs.

7. Pollution abatement is not a significant factor for either existing or presently contemplated needs.

8. Industrial use is not a significant factor for either existing or presently contemplated needs.

9. Irrigation use is not a significant factor for either existing or presently contemplated needs.

10. Drainage and reclamation of drained lands are not existing or presently contemplated factors in water [fol. 72] use.

11. Projects constructed and operated for control of floods and alleviation of flood damage will bring material benefits to the state.

"CONCLUSION

1. The highest public use of that portion of the Snake River from river mile 176.0 to river mile 247.0 is for hydroelectric power, fish, wildlife, livestock, domestic, and recreation uses. Such utilization is hereby encouraged for any properly state and federal licensed hydroelectric projects commensurate with multiple-purpose use for flood control, recreation, fish and wildlife and constructed and operated in accordance with plans approved by the State Water

Resources Board. Projects constructed for hydroelectric power purposes must include regulation facilities and operation as needed to minimize river flow fluctuations resulting from such project operation in order to protect downstream recreation, fish, and wildlife values and must be so operated as to provide minimum pool fluctuations during the recreation season while maintaining minimum perennial flows downstream.

2. Projects to utilize the aforementioned waters must be approved by the State Water Resources Board.

3. Water rights acquired for hydroelectric projects constructed for the purpose of utilizing the waters of the Snake River from river mile 176.0 to river mile 247.0.

[fol. 73] "Now Therefore Be It Resolved that this Board hereby adopts the following program in accordance with the provisions of ORS 536.300 (2) relating to the waters of the Snake River from river mile 176.0 to river mile 247.0:

"A. The maximum beneficial use of that portion of the Snake River from river mile 176.0 to river mile 247.0 is for recreation, fish, hydroelectric power, domestic, and livestock purposes and no appropriation of water in this area shall be permitted except for these uses.

"B. The highest public benefit to the state and the attainment of the highest and best use of the waters of the Snake River from river mile 176.0 to river mile 247.0 and the attainment of an integrated and balanced program for the benefit of the state as a whole will be achieved through utilization of the aforementioned waters for domestic, livestock, hydroelectric power, fish and wildlife, and recreation purposes and the aforementioned waters of the Snake River are hereby so classified.

C. Applications for the use of such water shall not be accepted by any state agency for any other purpose and

applications for such other purposes are declared to be prejudicial to the public interest and the granting of applications for such other uses would be contrary to the integrated, coordinated program for the use and control of the water resources of the state.

[fol. 74] D. Water rights acquired for structures or works for the utilization of these waters for hydroelectric purposes shall be subordinate to all present and future upstream beneficial uses of water except for hydroelectric power.

E. Structures or works for the utilization of the waters in accordance with the aforementioned classifications are also declared to be prejudicial to the public interest unless planned, constructed, and operated in conformity with the applicable provisions of ORS 536.310 and any such structures or works are further declared to be prejudicial to the public interest which do not give proper cognizance to the multiple-purpose concept.

"Done and dated this 5th day of March, 1960.

STATE WATER RESOURCES BOARD

/s/ DONEL J. LANE

By.....
Donel J. Lane
Secretary"

"IN THE MATTER OF THE APPLICATION OF PACIFIC NORTHWEST POWER COMPANY FOR A LICENSE, HIGH MOUNTAIN SHEEP PROJECT, SNAKE RIVER

FINDINGS OF FACT, CONCLUSION, AND ORDER

"This matter having come on for hearing upon proper notice on the 5th day of January, 1960 at the State Capitol,

[fol. 75] Salem, Oregon, before John D. Nichols, duly appointed hearing officer for the State Water Resources Board, upon the application of Pacific Northwest Power Company, an Oregon corporation, for a license for High Mountain Sheep Project, Snake River, the same having been referred by the Hydroelectric Commission of Oregon pursuant to ORS 543.225, the applicant appearing by Allen A. Smith, Hugh Smith, and John Foulkes Jones of Smith, Gray, Hill and Rodgers; and with other appearances as follows: Louis S. Bonney, Assistant Attorney General, for the State Water Resources Board; Lloyd G. Hammel, Assistant Attorney General, for the Public Utilities Commission, intervenor; Roy F. Atchison, Assistant Attorney General, for the Oregon State Game Commission and the Fish Commission of Oregon, intervenor; the Northwest Public Power Association, intervenor, appearing by its Executive Secretary, Gus Norwood; and witnesses having been called, testimony taken, and evidence received.

"As a result of this hearing the State Water Resources Board finds:

1. The Snake River from river mile 186 to river mile 247 has a substantial undeveloped power potential.

2. Applicant proposes utilization of a portion of this power potential through development of the High Mountain Sheep Project.

3. For purposes of comparison the applicant has evalu-
[fol. 76] ated the High Mountain Sheep Project in a system consisting of High Mountain Sheep, Lower Canyon, and China Gardens Projects; and has compared it to an alternative system including the Nez Perce and China Gardens Projects.

4. The High Mountain Sheep system would produce greater prime energy and greater dependable capacity than the Nez Perce system.

5. Currently the Nez Perce system has a more favorable benefit-cost ratio than the High Mountain Sheep system.

6. Either of these systems is economically feasible.

7. Energy from available major hydro alternatives or from steam sources would be higher in cost than energy produced at High Mountain Sheep.

8. The High Mountain Sheep system would provide more usable storage than the Nez Perce system.

9. Load forecasts indicate the regional power requirements might increase over a 1957 base by nearly 300 percent by 1975, over 400 percent by 1985, and over 1000 percent by 2010.

10. Flood control provisions of either system are adequate.

11. Power to meet applicants' requirements is not assured after August 31, 1963.

12. Either system, if constructed in its entirety, would intercept about 43 percent of the anadromous fish passing [fol. 77] over McNary Dam.

13. High Mountain Sheep Project would affect less than three percent of the fish passing over McNary Dam not now affected by existing projects, Snake River.

14. Nez Perce Dam presents special problems in fish passage that do not exist at High Mountain Sheep.

15. The applicant proposes initial construction of High Mountain Sheep and recognizes that any consideration of Lower Canyon should be held in abeyance until fish passage problems are solved.

16. Fishery experts state studies encompassing at least ten to fifteen years would be necessary to resolve some of the fish passage problems at high dams.

17. There are several possibilities for transportation of downstream migrants at High Mountain Sheep that might be feasible.

18. There is need for maintenance of minimum flows and limitations of flow fluctuations, Snake River, for navigational purposes.

19. Recreation values of the area would be enhanced by construction of either the Nez Perce system or the High Mountain Sheep system.

20. Minimum acceptable normal pool level for either High Mountain Sheep or Nez Perce should be 1510 foot elevation.

[fol. 78] 21. Anadromous fish runs of the Columbia River system are an important recreation and economic asset of the State of Oregon.

22. Acceptable alternatives for inundated spawning grounds should be provided.

23. There is need for a minimum flow, Snake River, above the confluence of the Snake and Salmon Rivers to provide attraction water for fish.

24. There is no evidence that either system would have either favorable or detrimental effects on the use of water for irrigation, domestic, municipal water supply, fire protection, or mining purposes.

25. There will be future upstream consumptive uses of water.

26. Deferment of construction which would provide power, flood control, and recreation benefits, would cause serious economic loss to the State of Oregon.

"CONCLUSION

"It is in the public interest that the power potential, Snake River, between river mile 186 and river mile 247, be

developed at the earliest opportunity to meet anticipated energy requirements of the State of Oregon.

"The numbers of fish involved and the inability to satisfactorily solve fish passage problems over high dams until at least 1970 or 1975, preclude construction of either Nez [fol. 79] Perce or Lower Canyon Projects.

"Utilization of these waters of the Snake and Imnaha Rivers for power production, flood control, recreation, wildlife, navigation, and fish life will represent the highest public benefit to the State of Oregon.

"ORDER

"The proposed High Mountain Sheep Project is in the public interest and it is hereby ordered that any state license issued by the Hydroelectric Commission shall be subject to the following provisions:

1. Water rights acquired for structures or works for the utilization of the waters of the Snake River for hydroelectric purposes from river mile 186 to river mile 247 will be subordinate to the use for all present and future upstream beneficial uses of water except for hydroelectric power.

2. Licensee shall provide suitable public access including roads to recreation reservoir areas. Recreation lands, facilities, and public access provisions shall be acceptable to and approved by the State Highway Commission. In the event of the inability of the licensee and the State Highway Commission to reach agreement, the matter shall be referred to the State Water Resources Board whose decision shall be final and binding upon all parties.

3. The licensee shall provide for the construction, modi- [fol. 80] fication, maintenance, and operation of such fish ladders, fish traps, or other fish handling facilities or artificial spawning facilities or other supplemental productive devices or research or experimentation for the purpose of

conserving and enhancing fishery resources; and comply with such modifications of the project structure and operations in the interest of fish life as may be prescribed hereafter by the State Fish and Game Commissions of Oregon. The licensee shall coordinate and cooperate with the State Game Commission to mitigate wildlife and game losses. In the event of the inability of the licensee and the State Fish and Game Commissions to reach agreement, the matter shall be referred to the State Water Resources Board whose decision shall be final and binding upon all parties.

4. The project shall be operated for flood control purposes in accordance with directives and instructions received from the Corps of Engineers.

5. When determined to be justified by the Corps of Engineers, minimum downstream flows for navigation purposes shall not be less than 13,000 cubic feet per second, measured at river mile 170.9, during seasonal refill or storage periods. When determined by the Corps of Engineers to be justified, flows shall be maintained at not less than 16,500 cubic feet per second, measured at river mile 170.9, during non-refill or storage periods.

[fol. 81] 6. A minimum flow of not less than 2,000 cubic feet per second shall be provided downstream from the project to the confluence of the Snake and Salmon Rivers for habitat and attraction water for fish.

7. In order to insure maximum recreational benefits during the period June 15 to September 15, daily pool fluctuations should not exceed one foot and weekly or seasonal pool fluctuations should not exceed three feet.

8. Flow fluctuations below the confluence of the Snake River and the Salmon River should not be more than one foot per hour unless approved by the Corps of Engineers.

9. The operation of this project should be integrated and coordinated with the Northwest Power Pool.

"Done and dated this 5th day of March, 1960.

STATE WATER RESOURCES BOARD

By /s/ ROBERT W. ROOT
Robert W. Root, Chairman

/s/ LASELLE E. COLES
LaSelle E. Coles, Vice Chairman

/s/ GEORGE H. COREY
George H. Corey

/s/ JOHN D. DAVIS
John D. Davis

/s/ LOUIS H. FOOTE
Louis H. Foote

/s/ RUTH HAGENSTEIN
Ruth Hagenstein

/s/ KARL W. ONTHANK
Karl W. Onthank"

* * * * * * *

[fol. 143] TESTIMONY OF K. M. ROBINSON

Witness for Pacific Northwest Power Company

Q. State your name, address, your position with the applicant, Pacific Northwest Power Company, and your background and experience.

A. Kinsey M. Robinson, Spokane, Washington. I am Chairman of the Board and a member of the Board of Directors. I was an inside wireman during the summer of 1911. I was foreman of an inside wiring crew in the summer of 1912. I got out of high school in the summer of 1913, and started digging holes, and progressed to lineman in July. I was a journeyman lineman by September.

Following that, I was a construction foreman. During the period from 1911 to September 1916 my employment was by the Idaho-Oregon Light & Power, a predecessor of Idaho Power Company. Following that I was local manager, Division Engineer, Division Manager and Assistant General Manager, all with Idaho Power.

Then I was vice president and general manager of Idaho Power beginning in August 1933, was elected president of Idaho Power in January 1934 and remained there as president until June 1938 when I became president of The Washington Water Power Company. Since May 1960 I have been Chairman of the Board and Chief Executive Officer of The Washington Water Power Company.

[fol. 144] Q. What were the reasons for the formation of Pacific Northwest Power Company and its relationship to its stockholding companies?

A. Shortly after the end of the second World War it became evident that the Pacific Northwest area would continue to grow rapidly and electric power requirements would continue to materially increase. Various utilities started construction on a number of new generating plants. The Washington Water Power built Cabinet Gorge and Noxon Rapids, both on the Clark Fork River. Pacific Power & Light Company added two units at Merwin, and built Yale and Swift projects on the Lewis River in the State of Washington. Portland General Electric Company built Pelton Project on the Deschutes, North Fork and Timothy Meadows on the Clackamas, and added additional units and other facilities at other plants on the Clackamas River. Montana Power built a modern steam plant at Billings, Montana, added a unit to its hydro installation at Kerr Plant on the Flathead River and has constructed the Cochrane plant on the Missouri River. All of these companies have instigated additional hydro projects and other sources of future power supply.

However, the potential available in hydro from projects which are available to the individual companies is relatively high in cost and a large number of the projects are

[fol. 145] clearly uneconomic. Economic hydro is chiefly available in projects too large for any one of the four companies to build. These companies have made contracts with other bodies to provide financing necessary to construct major hydroelectric plants.

Thus, Portland General, Pacific and Water Power all are among the purchasers under long-term purchase arrangements which, in effect, provided the financing for three major projects on the mid-Columbia River now under construction, Priest Rapids and Wanapum, licensed to the Grant County Public Utility District, and Rocky Reach, licensed to the Chelan County Public Utility District.

In the fall of 1953 these organizing companies considered a joint effort to develop major hydroelectric projects, and in April of 1954 five companies organized Pacific Northwest Power Company, the applicant in these proceedings. These five companies were Pacific Power & Light Company, Mountain States Power Company, subsequently merged into Pacific, Portland General Electric Company, The Montana Power Company and the Washington Water Power Company. There are as a consequence now four stockholders in Pacific Northwest Power Company, each of which owns one-fourth interest in the Company.

The staff work of Pacific Northwest is furnished by the professional staffs of the four companies, and the organiz-[fol. 146] ing companies have provided all of the funds to carry out the initial investigations and provide for the expenses of hearings in the previous proceeding and the expenses leading to the application which is the subject of this proceeding.

Q. Does Pacific Northwest presently operate any utility property?

A. No, it does not. It has no plant, no utility operations, generates no electricity, is making no sales, and will not become an operating utility until the electric plant has been built and is in service.

Q. Mr. Robinson, in your testimony in the previous proceeding in 1956 you testified that the Board of Directors

had three basic assumptions in mind, in the design of the Mountain Sheep-Pleasant Valley Project, and that these assumptions were that in the first place, Pacific Northwest Power wanted a good economical project that would provide an economical power supply to meet a portion of the load growth of the companies; secondly, to realize the greatest benefit to the area such a project would be designed as a complete unit in the Northwest Power Pool; and thirdly, that the company felt that a natural resource development of this magnitude must be designed with regard to all the diverse interests of the various water users that would be affected by the development. Will you state whether or not these assumptions also apply to High Mountain Sheep?

[fol. 147] A. Yes, they certainly do.

Q. Will you describe how the Company proposes to operate the project as a unit in the Northwest Power Pool?

A. As later witnesses will testify, this project has been designed for operation and coordination with the Northwest Power Pool, and the transmission facilities that we build for this project will be designed for integration with the Northwest Power Pool network. As we stated in our application, we will operate the project in coordination with the Northwest Power Pool to the extent practicable in view of recognition of benefits by other Pool members resulting from such coordinated operation. One method of operation of this project in coordination with the Power Pool, would provide that the project store water during the summer months and reduce generation to the minimum. This would not, of course, provide power consistent with the requirements of the companies' loads, and, unless such generation be found elsewhere in Pool resources the project could not be so operated. This generation is necessarily available, since that is the direct result of planned, coordinated operation. Since proper coordinated operation on an equitable basis in the long run benefits all parties concerned, I am confident that all parties will be willing

to develop agreements which will provide for coordinated [fol. 148] operation under fair and equitable terms.

Q. Will you state how you propose to operate the project for flood control?

A. We will operate the project for flood control in accordance with arrangements with the Corps of Engineers as provided in the license issued to us. Under certain circumstances this operation could result in a loss of power capacity, at a time when typically there would be a suplus of secondary available in the Pool. We consider that a proper recognition of this circumstance would require replacement or compensation for the impaired power capacity of the project. However, we recognize that the Chief of Engineers has stated that such replacement or compensation would require legal authority not presently available. Accordingly, we would assume that the Corps of Engineers, in scheduling our storage for flood control, will take into account the fact that under certain run-off conditions the use of our storage for flood control will result in an uncompensated loss to the owner of the project, which does not occur at other projects in the basin. In other words, we would expect that priority of use would be given to those projects where flood control storage does not result in financial loss, to the extent that this does not in any way interfere with effective flood control management.

[fol. 149] Q. Will you comment on the use of the project for recreation?

A. The letter of the Secretary of Agriculture commenting on the application, PNPC Exhibit 8, has recognized the recreation potentials of the project. The lake behind the High Mountain Sheep reservoir will become one of the largest lakes in the Pacific Northwest. It will be situated in an area of remarkably rugged scenic grandeur, and with extremely attractive climatic conditions. As part of the project we will construct access to this area from the town of Imnaha down to High Mountain Sheep dam, providing a good quality, hard surface all-weather road.

The Field Report of the Forest Service included as part of PNPC Exhibit 8 contemplates development of a series of camp sites and boat launching ramps. We have reviewed the report and have made a general examination of our own. We feel that a more detailed study and survey should be made before any developments are undertaken. However, in general, basic planning would provide for the location of a major camping site and boat launching ramp on the upper arm of the Imnaha reservoir, public facilities and boat launching ramps at the dam site, a major camping site and boat launching facilities at the Pleasant Valley area, together with a series of camping and picnic sites [fol. 150] accessible only by boat in the various inlets along the reservoir. This general concept appears to us to be a sound basic plan.

Whatever is developed in cooperation with the responsible agencies, which would include not only the Forest Service but also the responsible agencies of the State of Oregon and the State of Idaho, we propose to install the facilities in the immediate area of the project, which I have described. This would include the public area near the mouth of the Imnaha River, probably in Eureka Gulch, boat floats and docks, and a boat launching ramp at the reservoir, boat docks and facilities below the dam in the area opposite the mouth of the Salmon River, public parking facilities with a general area above the dam which would give a panoramic view of the dam, including, if we can find room which is quite difficult in this area, picnic facilities and similar public facilities.

In addition to this we propose to develop methods of handling boats around the dam. This would permit the continuation of the use of the Snake River as a navigable waterway to the hinterland of the Northwest. It also, at some time in the future, would permit regular voyages from the mouth of the great Columbia through the richness of the Inland Empire to the depths of the Grand Canyon of the Snake River.

The details of these proposals, in particular the details of administration, have yet to be worked out. From the [fol. 151] point of view of Pacific Northwest Power Company, we think the underlying consideration is to make sure that the enormous recreation and tourist potential of this area can be fully developed and utilized for the benefit of the citizens of the entire northwest. This will require the cooperation of a number of different agencies, and we pledge ourselves to work with them fully to see that a practical and sound program will be developed.

We regard the above general outlines of recreation development as being a plan consistent with the present remote and rugged and unsettled condition of the country. Whether more substantial recreation development should be undertaken may possibly depend upon the actual experience with this area after the project is in operation.

Q. Would you summarize the applicant's position on the High Mountain Sheep project?

A. The High Mountain Sheep plan of development will be substantially more economic, will provide substantially more power at site and downstream, substantially more storage, and substantially greater consideration of the needs of the fishery resource than would the alternative plan of development at Nez Perce. These points will be covered in detail by Mr. Bonin, Mr. Alspaugh and Dr. Hamilton.

Q. Will you describe the Company's financing plan?

* * * * * * *

[fol. 154] Q. What instructions did you give to Ebasco Services, Incorporated, with regard to the engineering designs and cost estimates that they were to prepare for Pacific Northwest Power Company?

[fol. 155] A. Insofar as the engineering in connection with the license application and the designs and costs estimates to be produced in this hearing on High Mountain Sheep, our instructions generally were to do the best engineering job they could and provide the most reliable cost

estimates that they could produce. With regard to the other projects in the Middle Snake reach, for which Ebasco has produced the engineering and cost estimates, we gave rather specific instructions. We instructed Ebasco to examine each site thoroughly and to do the same engineering and produce the same type of a cost estimate as though Pacific Northwest Power Company were applying for a license for that particular project. We told them to make up their own minds as to what type of structure to recommend, and that it should be the structure that in their opinion was the best and most economic. We instructed them that all the designs and engineering and the cost estimates were to be fully comparable to the designs and engineering and cost estimates that they were producing for High Mountain Sheep. In other words, in effect we instructed them to produce the same engineering information that we would require for our own use in making a choice of development of this region if there had been no necessity of a license proceeding whatsoever.

Q. Did you give any further detailed instructions to Ebasco?

[fol. 156] A. We instructed them to assume all projects to be completed in the same year. This was to enable us to make comparisons of the alternative plans of development as though there were no fish problem to be considered at all in making a decision. I wish to comment here that while this is a necessary basis for making that type of comparison, it is our opinion that the problems involved in the fishery resource of the Salmon River are of such importance that they become a prime factor in the conclusions to be reached here.

Secondly, we told Ebasco to exclude costs for fish facilities from their cost estimates. This is not because we would expect no such costs, but because we concluded on the advice of our own biologists, as Dr. Hamilton will subsequently testify, that there was no reasonable basis upon which any estimate for fish facilities could be arrived at

for either Nez Perce or Lower Canyon. We concluded that the projects can be best compared by excluding all cost estimates for fish facilities.

Thirdly, we instructed Ebasco to omit interest during construction from their cost estimates. Interest during construction was separately calculated by Mr. Alspaugh using the interest rate used for his analysis.

Q. Were any further instructions given Ebasco?

A. I believe that those were all the instructions that were [fol. 157] given to Ebasco by the Company. I do not, of course, include under the term "instructions" a series of data that were furnished to Ebasco for their use. These data fall into three classes. The largest class is data concerning hydraulic and electrical characteristics of the plant itself which have to do with such items as initial and ultimate installation, rated head, drawdown, characteristics of water flow, and other similar matters which are necessary in the design of the plant. These were furnished to Ebasco by Mr. Alspaugh. The numbers of transmission lines and sizes thereof, which were necessary for the design of the switchyard at the plant, were furnished to Ebasco by Mr. Blair. For the purpose of determining the economic feasibility of the project, or in other words, the cost of the project to Pacific Northwest Power Company, we wish to include the probable cost of fish facilities. For that purpose, a group consisting of the three biologists working for several of the companies, with outside independent consultation, developed specifications of fishery facilities of a type suitable for use at High Mountain Sheep. These were furnished, through a committee of which Dr. Hamilton was the chairman, to Ebasco, from which Ebasco developed design and made a cost estimate.

Q. You earlier mentioned that Pacific Northwest Power Company had requested Ebasco Services, Incorporated, to [fol. 158] prepare designs and cost estimates on other projects included in the alternative plans. You also described the position of Pacific Northwest Power Company

with relation to dams or on below the Salmon River. Will you state whether or not Pacific Northwest Power Company has any plans or proposals to build the Lower Canyon Dam on the Salmon River?

A. Definitely not. It has been frequently charged that Lower Canyon is part of our proposal. I want to emphasize now that we propose to build High Mountain Sheep Dam. We are including in this proceeding designs and plans for Lower Canyon Dam because, on advice of counsel, we were told that the development of the Salmon River for power and for flood control storage must be considered by the Federal Power Commission, under the Federal Power Act, and that it is encumbent upon us as the applicant to show what that potential might be.

Q. Will you further explain what the position of the Company is, in view of the several studies that will be introduced in evidence in this proceeding, with regard to the Lower Canyon project and eventual development of the Salmon River?

A. Our studies show conclusively that, if there were no question whatever of fish in the Salmon River, the High Mountain Sheep Plan of Development is superior in every respect to the Nez Perce Plan of Development. High Mountain Sheep Plan will provide more power at every stage of development and it provides more storage [fol. 159] for power and flood control, than the inferior Nez Perce Development. Our studies show this, the Corps of Engineers' studies came to the same conclusion; indeed, the power routing studies of both ourselves and the Corps of Engineers were accepted by stipulation as part of the basic studies for this proceeding; and, finally, the studies of the Oregon Water Resources Board have shown the same thing. Our studies show, furthermore, that the High Mountain Sheep Plan is significantly more economic, as Mr. Alspaugh will testify, in the first fifty years it will be worth $166,000,000 more than the Nez Perce Plan. Both High

Mountain Sheep and Lower Canyon will produce power cheaper than will Nez Perce, as shown by Mr. Alspaugh's computations.

If, therefore, there were no fish in the Salmon River, or if it were quite clear and beyond serious controversy that a dam of great height and large reservoir could be built with preservation of the fishery resource—I repeat, if either of these two things were true—then Lower Canyon should be promptly built, and our company would be an eager applicant.

But neither of these things are true. The question then is simple: If the salmon resource is of any importance at all, then the chance to preserve the resource justifies at least delay in development. If it does not, then this Com-
[fol. 160] mission should proceed to license Lower Canyon.

In our view, this is a case where, most emphatically, the situation justifies delay in construction of Lower Canyon to give further time to develop knowledge and techniques that today do not exist.

What I have said is against the background of a great deal of study of the area, and a close knowledge of our power requirements. We consider that the Salmon River must be recognized as placed in a unique status in the Pacific Northwest. We think it is proper under the Federal Power Act that that status be recognized and that the Commission should regard the Salmon River as a fish sanctuary until there have been tested and proven on other streams methods which will safely pass migrating salmon.

Q. Will you explain, Mr. Robinson, why the applicant did not include in its application any proposals for fish passage at High Mountain Sheep?

A. This explanation is set forth in full in the transmittal letter that accompanies the second amendment to our application in September of 1959. The fish facilities will, of course, be part of the project and whatever fish facilities are to be installed will be subject to the eventual
[fol. 161] approval and order of this Commission. The

orders of this Commission in previous cases have provided that the Commission would prescribe fish facilities upon the recommendation of the Secretary of the Interior and other responsible state agencies. We have felt that in this area, where government agencies such as the Fish and Wildlife Service, bear a major share of the burden of determining what the measures should be to preserve such a resource, it would be improper for us to formally propose facilities in advance of the recommendations of those agencies. We have, on the other hand, done a great deal of work on the facilities and we have formally submitted to the responsible agencies designs of facilities that, as Dr. Hamilton will subsequently testify, have been developed, in view of the unique situation at High Mountain Sheep, to utilize as far as possible proven experience at other projects. These facilities will be quite costly—more costly than any cost estimates for any of these projects by government agencies would have indicated. For that reason, we felt that it was encumbent upon us to include what would appear to be the probable cost of these facilities in our own economic feasibility studies. For that reason, we will introduce in the record the estimate of what these facilities will cost, but we do not propose to introduce in the record any specifications as to the facili-
[fol. 162] ties or details of them, since they are not subject to approval by the Commission at this time.

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[fol. 166] Testimony of CHARLES C. BONIN

Witness for Pacific Northwest Power Company.

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[fol. 192] Q. What operating characteristics have you taken into account in designing the project?

A. I have designed the project to operate in the Northwest Power Pool and I have, therefore, taken into account the operating characteristics of a major storage facility

operating in that Pool. In general, these characteristics are that the project will operate at high loads during the daytime hours and at minimum loads at night and over the week end, maintaining required minimum flows at down-
[fol. 193] stream points. After the construction of a downstream project with sufficient pondage, the High Mountain Sheep Development will be shut down at night and over the week ends.

On a seasonal basis, the storage reservoir will be called upon to supplement the natural flow of the river during the period from August to March of each operating year. The reservoir will then be refilled from excess flows in the spring runoff season.

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[fol. 268] Testimony of A. E. ALSPAUGH

Witness for Pacific Northwest Power Company.

Q. Will you state your name, address and present occupation?

A. My name is A. E. Alspaugh, and I reside at 7825 S. E. Reed College Place, Portland, Oregon. I am employed as a Senior Development Engineer for the Pacific Power & Light Company.

* * * * * * *

[fol. 275] High Mountain Sheep Development Power Study

Q. Have you conducted studies of the operation of the High Mountain Sheep Project so as to determine its power potential, its hydraulic characteristics, its operation for flood control, navigation and other purposes?

A. I have.

Q. Does PNPC Exhibit 17, a document entitled "High Mountain Sheep Hydro-electric Development—Power Production Study" set forth tables and charts giving the results of your power production study?

[fol. 276] A. It does.

Q. Will you indicate generally the contents of PNPC Exhibit 17?

A. Summarized in this document are the power studies assuming High Mountain Sheep operating in a system capable of serving approximately a 15,000,000 kw peak load. It reflects the power that High Mountain Sheep would create at site and at downstream installations when it would begin operation.

Q. On Sheets 1 and 2 of PNPC Exhibit 17 you define several terms. Why are these included?

A. In order to add clarity in the use of the terms throughout my exhibits.

Q. What do you include under Load Characteristics?

A. In order to conduct a power study it was necessary to establish the load shape for both the Organizing Companies and the Power Pool. Table 1 gives the loads and load shape for the organizing companies for the 1967-68 year drawn from PNPC Exhibit 27. The Power Pool load data as shown on Table 2 are those set forth in the data stipulated for routing studies in Pre-hearing Conference Exhibit No. 9.

Q. What period of water records did you use for your power study?

A. I used the twenty-year period of water supply record beginning in July 1928 and ending in June 1948. This [fol. 277] twenty-year period is commonly used by utilities of the Northwest Power Pool and other agencies for similar studies in this area. This is in accordance with the agreement at the Prehearing Conference in Washington, D. C. on May 17, 1960.

Q. Have you examined the water supply records to determine whether the run-off at the High Mountain Sheep Project during this twenty-year period is higher or lower than the long-term record?

A. Yes, I have. I found upon examination of run-off records for the Oxbow Station which approximates 97 per cent of High Mountain Sheep run-off, that on comparable bases the mean of this twenty-year period is about 95 per cent of the long-term mean of the forty-year period beginning in July 1913 and ending in June 1953.

Q. What streamflow data did you use in your studies?

A. I used the streamflow data set out in Prehearing Conference Exhibit Nos. 18, 19 and 20. These data are tabulated for the respective time levels of 1960, 1985, and 2010 on Tables 3, 4 and 5 of PNPC Exhibit 17.

Q. Will you indicate the power plants, or more generally explain the system in which you operated High Mountain Sheep initially?

A. On Table 6 of PNPC Exhibit 17, I have shown the [fol. 278] Initial System to consist of two groups. The first group includes all the plants on the Columbia River and its major tributaries whose regulated operation is substantially related to the operation of High Mountain Sheep and for that reason should be studied individually. These are tabulated as items 1 through 24. The second group plants, shown as Item 25 of this tabulation, have been grouped together because the slight variation in generation does not warrant detailed separate analysis. The power production from this second group has been tabulated on Table 7, PNPC Exhibit 17 which is identical with that agreed to in Prehearing Conference Exhibit 11. I have included, in one or the other group, all existing plants, all plants under construction, and the additional plants that were stipulated for comparative studies in Item 3, page 4 of the Transcript of Prehearing Conference, Washington, D. C., May 17, 1960.

Q. What downstream projects are assumed in operation in addition to existing plants?

A. Ice Harbor is assumed in operation in December 1961, John Day in the fall of 1967 and Lower Monumental is scheduled in the fall of 1968. The plants that I have listed in this and the previous answer are those agreed to be included in system studies at the Washington, D. C. Prehearing Conference of May 17, 1960, as listed under item [fol. 279] 3 of page 4 of the transcript, excluding the "common reach".

Q. Will you please discuss basic assumptions in operation?

A. The system was operated to produce the maximum firm load-carrying ability and to generate the maximum amount of high quality secondary energy; other multipurpose uses were recognized at those projects which have such purposes. Such operation established a definite pattern and time of release of stored water from one reservoir with respect to another.

Q. Will you discuss Initial System Average Prime Energy?

A. The 1936-37 operating year is the adverse water year for the Initial System and the period in that year of September 15 through April 15 is the critical hydro period. Production during this period will be the system average prime energy, which is about 10,120,000 kw which, in turn, establishes the system's firm load-carrying capability. Sheet 1 of Table 8, PNPC Exhibit 17, summarizes the power output of the Initial System.

Q. Will you describe the twenty-year power analysis?

A. The practices followed in the power studies are intended to simulate actual operating conditions encountered in power pool operation. This procedure results in obtaining power generation data which approximates the genera- [fol. 280] tion which could be expected under actual operating conditions. The firm load-carrying ability of the Initial System having been determined, monthly power studies were initiated as of the operating year beginning July 1928 and carried through June, 1948. All storage reservoirs were assumed to have been full at the start of the study. Procedures followed in this twenty-year study are described as follows:

1. Tentative operation procedures were adopted based upon studies of critical and average operating years.

2. Multipurpose uses other than power were established as required for each project.

3. With respect to storage reservoir operation, minimum water discharges for power or other purposes were established.

4. Power Operations were conducted on the basis of two key forecasts. It was assumed that the thirty-day stream flow forecasts are available and have 100 per cent accuracy throughout the operating year. Actual stream flow data for the ensuing month at each project were used as the basis for the thirty-day forecast. Secondly, it was assumed that runoff volume forecasts are available from January 1, through August for any storage reservoir.

5. Reservoirs were not drafted below critical year levels except when necessary to carry firm loads.

[fol. 281] Q. Will you discuss the electronic computer program?

A. Detailed month-by-month power routing studies were programmed and carried out on an electronic computer which, through its speed and accuracy, permits obtaining power routing data on a system and its component plants in a manner far superior to such studies previously done manually. Sheets 2 through 21 of Table 8 are a direct reproduction of the summary print-out from the computer analysis.

Q. Will you discuss the reservoir operation?

A. Operation curves for the major storage reservoirs are shown on Chart 1, PNPC Exhibit 17. These curves resulted from modification of "tentative" operating procedures as described under step (1) of my answer on "Twenty-Year Power Analysis." In order to fully protect firm loads, only two modifications were found to be necessary for all historic run-off conditions. It was found necessary to alter the Grand Coulee operation to retain at least 800,000 acre-feet on April 1 in order to assist in carrying the firm load for years with a late and low runoff. The Albeni Falls operation rule curve was modified to delay storage drafts approximately one month in order to protect firm loads in the years when the runoff during January, February or March was less than that for the same period in the critical year.

[fol. 282] Q. Have you summarized the results of the twenty-year study?

A. Yes. Table 8, Sheets 2 through 21, of PNPC Exhibit 17 is a yearly summary of the potential power production by months for the Initial System in which High Mountain Sheep Project was operated. Sheet 1 of Table 8 is a grand summary of the power production of the individual projects of the system. Chart 2 graphically gives the power duration which illustrates the availability of secondary energy during the operating year. It will be noted that for the months of May, June and July there is always a large amount of secondary energy, but that for the remaining part of the operating year the amount varies from none to substantial blocks depending on the amount of water supply being experienced throughout the Power Pool.

Q. You have stated that Table 8 of PNPC Exhibit 17 provided summary data for the Initial System in which High Mountain Sheep was operated. Would you describe the data contained on Sheets 1 and 10 of this tabulation?

A. Sheet 1 is a summary of the twenty-year power routing study that was conducted in which High Mountain Sheep was operated. It shows the average energy capability for each project for the 1928-1948 period. Sheet 10 [fol. 283] is a photographic reproduction of the summary table of the computer study for the 1936-37 year, which contains the critical period for this system. As I have indicated before, Sheets 2 through 21 are reproductions of the summary for the respective years as taken from the computer study that was run for each month of each year of the 1928-1948 twenty-year period.

Q. What power generation do you obtain from High Mountain Sheep both at site and downstream?

A. The power output from High Mountain Sheep after return of overlap power to licensed Hells Canyon is shown on Table 9. These data are also shown graphically on Chart 3. The project average prime energy is 761,000 kw, with 6,338,000,000 kwh of annual firm energy when oper-

ated as an integrated unit in the Power Pool and then related to the characteristics of the load of the Organizing Companies. Initial maximum capability of High Mountain Sheep is established at 1,000,000 kw which, with other capacity available to the Organizing Companies will result in an increased dependable capacity of 1,208,000 kilowatts at a 63.0 per cent storage control period load factor. Average Annual Energy generation at High Mountain Sheep project is 5,483,000,000 kwh, of which 3,833,000,000 kwh is produced during the storage control season (September 15 through April 15) and 1,650,000,000 kwh is produced during the reservoir refill season (April 15 through September 15). Also, the project through integrated pool operation, [fol. 284] will enable the downstream plants to increase their average prime energy production. This increase will be 104,000 kw for Ice Harbor, McNary, The Dalles and Bonneville; 35,000 kw for John Day; and 32,000 kw for Lower Monumental, which has been assumed developed in the Initial System, for a total increase of 171,000 kw.

Q. Did you furnish Mr. Tonetti the average generation that future units 6 through 10 would add to the initial system generation and, if so, what were the amounts.

A. Yes, I furnished the following data to Mr. Tonetti. Units Number 6, 7, 8, 9 and 10 would add 5.1, 4.7, 3.7, 2.0 and 1.4 average megawatts respectively.

Q. Can you explain the difference between the figures on Table 9 and Sheet 10 of Table 8 of PNPC Exhibit 17 for the critical year operation of High Mountain Sheep.

A. Table 9, which is the revision of Table 2 of Exhibit I of the Application for High Mountain Sheep License, shows the net output available at High Mountain Sheep after replacement of overlap power to the licensed Hells Canyon Project whereas High Mountain Sheep data on Sheet 10 of Table 8 is actual generation.

Q. How did you determine the power plant characteristics, particularly the initial installation, the required hydraulic capacity, rated head for the turbine, and the

minimum power pool for the High Mountain Sheep Project, [fol. 285] which you furnished Mr. Bonin?

A. The data furnished Mr. Bonin principally came from the power routing studies. However, three special considerations affected the initial installation. First, present resources of the Organizing Companies would permit operating the project at a relatively high load factor because the Organizing Companies have available extra capacity for a limited period. Second, operation of the project at a relatively high load factor would permit water releases without requiring a re-regulating dam. Third, the planned installation permitted a more economic transmission utilization.

Minimum pool was established, as is customary in a storage project, by determining the point at which further storage withdrawals would not create any net power benefits. This point will vary depending upon the system the project is operating in and the value of capacity and energy at that time. Rated head of 550 feet was established after taking into account the expected project operation during its initial period when its head range will be greatest as well as the expected operation of this project in later time levels of regional development.

Q. Did your power routing studies provide for operation of this project for flood control purposes?

[fol. 286] A. They did. Chart 3 of PNPC Exhibit 17, which is a revision of Sheet 2 of Exhibit I of the Application, will show on examination under "Reservoir Contents" that the reservoir was drafted and held for flood control purposes in a number of years of operation. This is particularly evident on this chart in 1933, 1935, 1936, 1943, 1946 and 1948, which shows that the reservoir was held level for a period in excess of a month in each instance for flood control purposes. In 1943 and 1946, as well as in 1948, you will notice that the reservoir was spilling through the low level sluices. This spill, of course, was to maintain reservoir storage space for flood control purposes.

Q. Would you explain in general the manner in which you used storage on the Middle Snake River for flood control.

A. In conducting system power studies in connection with the developments in the Middle Snake River, use of Brownlee and High Mountain Sheep storage for flood control has been made in accordance with the Corps of Engineers' system flood control plan for controlling flows of the Columbia River, particularly those on the river below the Dalles.

Brownlee storage has been operated for flood control in accordance with Federal Power Commission license provisions. At the time this study was conducted, we were not [fol. 287] informed of the Corps of Engineers' requirements for flood control, so that, based on our estimate of requirements, High Mountain Sheep storage has been operated to provide 750,000 acre-feet of flood control space by March 1st of any year. The amount requested by the Chief of Engineers (PNPC Exhibit 6) 600,000 acre-feet on March 1st, would increase the power capacity of High Mountain Sheep, but I have not adjusted my study for this purpose. Additional flood control space would be made available thereafter on the basis of flood forecast. Brownlee and High Mountain Sheep storages in any flood operation are used as one. Therefore, based on the Corps of Engineers' March 1st forecast, an amount of space up to 3,250,000 acre-feet, if requested, can be made available by May 1st at these developments. Such space can be held until the Corps of Engineers permits refilling. It has been assumed that such filling will be based on having the reservoirs refilled by July 1.

In the power studies, these reservoirs have been operated for flood control based on March 1st forecasts considering the need for flood control on the Lower Columbia River. The years during the twenty-year period that storage in addition to 750,000 acre-feet was used at High Mountain Sheep were 1933, 1936, 1938 and 1948.

Q. Are you familiar with the letter of Chief of engineers [fol. 288] addressed to the Chairman of the Federal Power Commission dated 24 February 1960, identified as PNPC Exhibit 6?

A. I am.

Q. Has the operation of the reservoir in the power routing studies which you have conducted been substantially in accordance with that letter with regard to flood control?

A. It has.

Q. Can the project be operated for navigation as outlined in the Chief's letter?

A. Yes, the project can be operated to provide the flows at Lime Point requested by the Corps and within the probable change in river stage indicated. I would point out that during the refilling season during the summer of 1931 and 1937 an average minimum flow of 10,000 cfs during most of July, August, and September, totaling five months, was provided below the confluence of the Snake and Salmon Rivers. If the Corps were to determine the interests of navigation required 13,000 cfs flow, the effect on my studies would be to reduce the usable and marketable energy generation of the whole system by about 850,000,000 kwh for these years, of which about 470,000,000 kwh would be at High Mountain Sheep.

Q. What criteria did you follow with respect to establishing the minimum regulated flow at High Mountain Sheep project?

[fol. 289] A. I used the following minimum flow criteria:

a. The discharge from High Mountain Sheep would be maintained so that when combined with inflow between High Mountain Sheep and Lime Point, 13,000 second-feet would be provided at Lime Point. Flows less than this amount occurred only twice in the period of study and were during the months of July, August, or September.

b. The minimum average discharge from High Mountain Sheep would be 2,000 second-feet, and a minimum of

10,000 second-feet would be maintained below the mouth of the Salmon River at all times.

c. Refilling operations for Brownlee and High Mountain Sheep reservoirs under normal conditions were based on passing a mean monthly discharge of 5,000 second-feet from Mountain Sheep. During years when run-off forecasts indicate that Brownlee and High Mountain Sheep reservoirs would not refill by passing 5,000 second-feet, the mean monthly discharge from High Mountain Sheep was reduced to 2,000 second-feet during the period when the outflow from the Salmon River was 8,000 second-feet or greater. When the Salmon River is carrying less than 8,000 second-feet, then Mountain Sheep outflow will augment the Salmon River flow to maintain 10,000 second-feet or will pass the flow from the Hells Canyon Project.

[fol. 290] d. The rate of rise or fall of the Snake River below High Mountain Sheep would be restricted to minimize adverse effect on navigation and fishery interests.

Q. I ask you whether the power routing studies have provided for the operation of this project for power in accordance with the last paragraph on page 3 of the Chief of Engineer's letter (PNPC Exhibit 6) concerning power operation?

A. The power routing studies that I have conducted are made to yield the highest amount of prime energy for the system as a whole, together with providing the greatest amount of high quality secondary energy. Since this operation has tended to yield the greatest amount of usable power for the system as a whole, it necessarily follows that at any one moment of time any one particular project may be generating more or less than it might otherwise do. Since the net effect of such an operation results in greater over-all benefits for all members of the system, the operation necessarily assumes that arrangements can be made whereby the mutual benefits are recognized and provided for. Thus, for example, as an examination of

Chart 3 of PNPC Exhibit 17 will show, the normal summertime operation of this project calls for it to store run-off water during period of surplus generation at other projects and thereby create additional energy during the [fol. 291] storage period with the use of this stored water.

Of course, this means that the Organizing Companies must find other generation to carry their load during the period of time when High Mountain Sheep generation is being curtailed through system operation. The generation is, of course, available in the Power Pool, as shown by my Power Routing Study. The Companies could, of course, operate this project through the summer and carry their own load. The result would be a decrease in the prime energy both at the project and downstream, since it would result in passing water to downstream projects during the summer months at a time when they could not utilize it. The report of the Division Engineer recognized the need of mutual arrangements to provide proper coordinated operation and the example I have given illustrates the necessity of such mutually satisfactory agreements if the full benefits assumed in my power studies and called for by the Chief's letter are to be realized.

Power Study of Alternative Plans

Q. Have you conducted a study to determine the power resources of the Middle Snake River that would result if it were developed by High Mountain Sheep in conjunction with other projects that provide development comparable to that achievable with Nez Perce?

[fol. 292] A. I have.

Q. Will you generally describe the study that you have conducted?

A. I have analyzed two alternative plans of development of the reach of the river affected by Nez Perce. One plan includes High Mountain Sheep. The other plan includes Nez Perce. The two plans were studied to determine their power potential, hydraulic characteristics, operation for flood control, navigation and other purposes.

Q. Have you prepared a report on the studies you have made on the power potential of these two alternative plans?

A. I have.

Q. Is the document bound in the brown cover, entitled "High Mountain Sheep Plan and Nez Perce Plan, Power Production Study, 1960" consisting of Tables 1 through 23, including Tables 10A, 10B, 11A and 11B, and Charts 1 and 2, and identified as PNPC Exhibit 18, that report?

A. It is.

Q. Will you state what projects are included with High Mountain Sheep?

A. The group of projects which provide development for power and flood control comparable to that achievable with Nez Perce, includes High Mountain Sheep Project, pool elevation 1510; Lower Canyon Project at Salmon River mile 3.7, pool elevation 1595; and China Gardens at [fol. 293] Snake River mile 172.5, pool elevation 945.

Q. Will you explain these projects?

A. The projects that I have listed are those included in the "common reach" in the report of the Prehearing Conference of May 17. To make an adequate comparison of two alternative proposals the same potential resources must be developed, if physically possible and economically feasible. The technique of doing this is to establish a common reach. This is defined as including projects up and downstream of both alternatives until a common point, a point which is common to both projects, is reached in the river. China Gardens Project was recommended as the site used for these studies by the Corps of Engineers, and it was included in the Corps studies on these alternatives. Design and cost studies made by Mr. Bonin for China Gardens when analyzed against power benefits indicate that this project is engineeringly and economically feasible. This was also indicated by Corps of Engineers' data. Consequently, the tailwater of China Gardens is the downstream common point for both alternative plans. The tailwater of Hells Canyon is similarly the upstream common

point for both plans on the Snake River. This point is fixed by the issuance of the license by this Commission to the Idaho Power Company. Since Nez Perce develops the lower Salmon River, potential development on that river [fol. 294] to a common point must be examined. On the Salmon River, the common point in both plans is the Freedom site.

Q. Would you state what projects are included in your comparable study with Nez Perce?

A. The comparable group of projects, which collectively are termed the Nez Perce Plan, includes the Nez Perce Project, pool elevation 1510 and the China Gardens project on the Snake River, Mile 172.5, pool elevation 920. Except for Whitebird and Freedom, these are the projects listed in the "common reach" in the Prehearing Conference of May 17.

Q. Would you state why you did not include Whitebird Project in the Nez Perce Plan?

A. The Whitebird Project, which would develop the remaining Salmon River head to the Freedom site, would provide initially only 22,000 kilowatts of average prime energy which would have an annual value of approximately $1,200,000. Based upon the project construction cost of $36,000,000 as testified by Mr. Bonin, I calculated the annual cost to be approximately $1,500,000. Therefore, the project would have initially a benefit-to-cost ratio of 0.8 to 1 which would, if included with Nez Perce, become an economic liability to the Nez Perce Plan of development. Since the benefit-to-cost ratio of the incremental benefits [fol. 295] are less than unity, standard analysis as set forth in "Proposed Practices for Economic Analysis of River Basin Project" (the "Green Book"), a Federal Government publication of the Subcommittee on Evaluation Standards of the Inter-Agency Committee on Water Resources, requires that the project be omitted. Inclusion of Whitebird at this time would worsen the position of the Nez Perce Plan in the comparison I make later. However, I

would note that at such time as storage at the Crevice Project upstream of Whitebird is developed the economics of the project would improve. In the Division Engineer's report, Crevice is not recommended based on the fact it is in a wilderness area. Furthermore, of course, the Crevice project faces the same problems of fish passage as face Nez Perce or Lower Canyon. Under these circumstances, I have been unable to determine when it would be reasonable to assume the Crevice project in operation. Such development, therefore, will apparently take place, if at all, at some time in the future and, consequently, a determination of the probable economics of the Whitebird project would be questionable. While the inclusion of Whitebird in the Nez Perce Plan would increase the benefits of that plan, at the same time the cost would be increased. The potential benefits available from Whitebird are such that [fol. 296] it is my judgment that any improvement in economics of Whitebird would not be sufficient to affect the conclusions of the comparative analyses of the two plans.

Q. Will you discuss the appropriate treatment of Freedom Project?

A. The Division Engineer's report proposes Freedom as a potential project for future development below the Crevice Project. Required river regulation at the Freedom project would be provided by Crevice upstream. Without Crevice storage, Freedom is uneconomic, and, therefore, has been omitted from my studies for the reasons already stated for White bird. At such time as Freedom is constructed, it would be affected by overlap storage of the downstream project in the same manner as Hells Canyon on the Snake River, and this effect would, of course, be shown in studies for such a time in the same manner as my studies show Hells Canyon.

Q. Will you state the basis for determining normal pool elevations at the several projects of the two plans.

A. With respect to each of the China Gardens projects, I established pondage that would be used for the necessary regulation of the upstream projects. This pondage indi-

cated the amount of daily and weekly drawdown, and I established an overlap on each of the projects to avoid any [fol. 297] substantial loss of head as a result of daily and weekly drawdown.

The establishment of the pool level at Lower Canyon is a function of several factors, including a determination of usable additional power resulting from increased head and storage availability, application of comparable criteria in establishing overlaps, and the character and management of storage on the Salmon River. The establishment of the 1510 elevation for Nez Perce and High Mountain Sheep provides a 35-ft. overlap on the Hells Canyon Project. As indicated in the routing studies, this overlap storage results in only a small loss of power at the upstream project and a substantial gain of power at the downstream projects. Accordingly, I established a similar overlap on the Freedom project. At such time as the Freedom project might be constructed the overlap will similarly result in a substantial addition of power at the downstream projects, with a very small loss of power at Freedom. Pending construction of Freedom the additional height develops an additional 30 feet of head on the Salmon River. The pool levels for High Mountain Sheep and Nez Perce have been stipulated to in the Engineering Items of Agreement, San Francisco, July 11 and 12, 1960.

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[fol. 310] Q. Did you determine the amount of usable storage in the two plans?

A. I determined optimum use of available storage in both plans by comparable procedures. The results show that the High Mountain Sheep Plan has a usable storage of 5,515,000 acre-feet, out of a total gross storage of 7,420,000 acre-feet, or about 74 per cent. Nez Perce Plan has a usable storage of 5,015,000 acre-feet of a total gross storage of 6,600,000 acre-feet, or about 76 per cent. This is a drawdown at High Mountain Sheep of 173 feet, 325 feet at Lower Canyon and 240 feet at Nez Perce. The

resulting acre-feet figures are from the reservoir capacity tables that were agreed to as Prehearing Conference Exhibits Nos. 5, 6 and 8.

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[fol. 312] Q. What is the reason that the High Mountain Sheep Plan has greater, power potential, even if Whitebird is included with the Nez Perce Plan so as to provide the same development of head?

A. There is 500,000 acre feet of usable storage which I have indicated the High Mountain Sheep Plan has in excess of the Nez Perce Plan. In addition, placement of the storage in two different reservoirs permits more efficient utilization of storage. Characteristics of the Snake and the Salmon Rivers are quite different. The Snake River is an extremely well-regulated stream, with more than 7,000,000 acre-feet of storage already existing upstream of High Mountain Sheep. The result is illustrated by the fact that while usable storage available at High Mountain Sheep is 3,100,000 acre-feet, only 2,250,000 is actually used in my studies at the High Mountain Sheep Project. As the years go by and more and more storage is developed in the Columbia Basin, less and less of the storage in this part of the Snake River will be used in years other than the adverse water period. This will permit the High Mountain Sheep reservoir to be maintained at a relatively high level in order to maximize energy production and peaking capa-
[fol. 313] bility. On the contrary, the Salmon is completely undeveloped and the efficient utilization of storage on that stream is entirely different than it is on the Snake River. This storage on the Salmon must be used nearly every year in order to make space to avoid reservoir spill during the heavy run-off period in May and June. Therefore, High Mountain Sheep and Lower Canyon reservoirs in combination permit the most effective utilization of storage in view of the different run-off characteristics of the streams. At Nez Perce, unfortunately, a compromise must be reached, and the result is reduction in power potential.

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[fol. 434] Testimony of CHARLES KEITH WILLEY Vice-President and Western Manager Harza Engineering Company.

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[fol. 483] Q. Please describe briefly the section of the Snake River and its tributaries included in your studies.

A. The Snake River is a major tributary of the Columbia River joining the Columbia near Pasco, Washington. The Snake River drainage area extends into the states of Nevada, Utah, Wyoming, Idaho, Oregon, Montana, and Washington. The Middle Snake River extends from Weiser, Idaho, downstream to Lewiston, Idaho, and includes the major tributaries entering that reach. Within the reach of the Middle Snake River upstream from the [fol. 484] Mountain Sheep damsite, the two dams, Brownlee and Oxbow, are being built under FPC license. Brownlee is in operation. A third dam, the Hells Canyon development, has been licensed for construction. The Middle Snake River and its tributaries flow through deep and rugged canyons which offer excellent opportunities for water resources development. A number of potential damsites exist in this section of the Snake River and its tributaries.

The principal damsites other than those already constructed or licensed for construction on the Snake River are the Pleasant Valley, Mountain Sheep, Nez Perce, China Gardens and Asotin Sites. Those on the Salmon River are the Lower Canyon, Whitebird, Freedom, and Crevice Sites. Wenaha damsite is located on the Grande Ronde River.

Q. How are river miles referenced to the Snake River and its tributaries?

A. River miles on the Snake River are computed from its junction with the Columbia River. River miles of each major tributary are computed from the junction of that tributary with the Snake River.

Q. Please identify in terms of approximate river miles some of the principal landmarks and damsites.

A. Progressing upstream on the Snake River, Lewiston, Idaho, is at River Mile 139.0; Asotin damsite is at River

[fol. 485] Mile 146.8; the mouth of the Grande Ronde River is at River Mile 168.8; China Gardens damsite is at River Mile 172.5; Nez Perce damsite is at River Mile 186.2. The mouth of the Salmon River is at River Mile 188.4; High Mountain Sheep damsite is at River Mile 189.2; the mouth of the Imnaha River is at River Mile 191.6; Lower Mountain Sheep is at River Mile 193.0; Hells Canyon damsite is at River Mile 247.6; Oxbow Dam is at River Mile 273.0; and Brownlee Dam is at River Mile 285.0. Proceeding upstream on the Salmon River, the downstream Lower Canyon damsite is at River Mile 0.5; the upstream Lower Canyon site is at River Mile 3.7; the Whitebird damsite is at River Mile 59.8; Freedom damsite is at River Mile 69.3; and Crevice Damsite is at River Mile 99.7. Wenaha damsite is at River Mile 26.7 on the Grande Ronde River.

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[fol. 624] Testimony of ROBERT B. GALLUP Principal Engineer, R. W. Beck and Associates.

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[fol. 640] Q. Have you studied the operation of the Nez Perce Project as it will be related to the future operation of the other power producing facilities in the Pacific Northwest?

A. Yes, I have.

Q. Please explain the basic considerations on which your studies were based.

[fol. 641] A. The first consideration on which my studies were based is that the resources of the Pacific Northwest should be developed and used in such a manner that the greatest benefit to the region will result.

This means that the operation of the Nez Perce reservoir must be coordinated or integrated with other reservoirs and other power producing facilities in the Pacific Northwest.

In order to affect this coordination or integration, provision must be made with the owners of the other projects

in the Pacific Northwest to carry the load imposed on the Washington Public Power Supply System when the output of the Nez Perce Project is reduced to store the stream flows in the Nez Perce reservoir and hold the stored water for release when it will provide the greatest benefit.

Q. What years did your studies cover?

A. My studies covered the first year of operation of the Nez Perce Project, assumed to be 1967-68 and operation of the Nez Perce Project in the Pacific Northwest power supply program in 1984-85.

Q. In your opinion, what conditions will govern the operation of the Nez Perce Project during these two periods?

A. The operation of the Nez Perce Project during its first year of operation will be as a part of a power supply in the Pacific Northwest consisting primarily of [fol. 642] hydro-electric projects. As time goes on, I believe that the additional power supply installations in the Pacific Northwest will consist of steam power plants as well as hydro-electric plants. In my opinion, substantial amounts of steam power will be required in the Pacific Northwest by 1984-85.

Q. How will this affect the operation of the Nez Perce Project?

A. With respect to the operation of the Nez Perce project in the 1967-68 power supply program, the basic value of the project to the Pacific Northwest is in its ability to provide energy both at-site and downstream during the critical period of water flows in the Pacific Northwest. This period is now considered to be under a repetition of the stream flows of September 16, 1936 through April 15, 1937. Existing and under-construction hydro-electric projects in the Pacific Northwest will have surplus peak capability during the year 1967-68 and thus, from an overall Pacific Northwest standpoint, loss of peaking capability as a result of heavy reservoir drawdown would not be significant. Furthermore, the production of secondary

energy would have little value unless a market for secondary were developed by that time.

As the Pacific Northwest power supply system progresses [fol. 643] to a hydrosteam system, the high plant factor steam energy provides an energy base which would make more usable the peaking capability of the Nez Perce Project and would also provide a market for secondary energy from the project as steam displacement energy.

Q. When, in point of time, do you believe that the hydro-steam system will become effective in the operation of the Nez Perce Project?

A. Assuming development of loads as forecast by the FPC in Appendix C, part 5 of the Water Resource Development Report on the Columbia River dated June, 1958 prepared by the Army Engineers and assuming resource development equivalent in magnitude to Sequence IV H as described in that report, I believe that the hydro-steam system will become effective in the operation of the Nez Perce Project within fifteen years after it is placed into initial operation.

Q. How long will this condition last?

A. I believe that it will last as long as the Nez Perce Project continues to operate.

Q. Do you believe that the basic value of the Nez Perce Project should be determined as a segment in a hydro-steam system?

[fol. 644] A. Yes, I do. If one were to assume the basic life of the Nez Perce Project at 100 years, the interim period until the hydro-steam system is reached would be less than 15 per cent of its useful life. Operation of the Nez Perce Project in a hydro steam system would be for a period which would be in excess of 85 per cent of its useful life, in that event.

Q. What is the importance of analyzing the Nez Perce Project during the interim period before the hydro-steam system will take effect?

A. The importance of analyzing the Nez Perce Project for the interim period before the hydro-steam system takes

effect is to determine the project's operating characteristics and power costs under those conditions, so that the cost of power from the Project during the interim period may be determined. Furthermore, the initial installation at the project should be based upon the interim period operation with full consideration being given to the hydro-steam operation characteristics in determination of ultimate installed capacity.

Q. What do you anticipate the power supply situation will be at the time the Nez Perce project will be completed?

A. Assuming the Nez Perce Project completed in 1967-68, I would anticipate that the power supply in the Pacific [fol. 645] Northwest will primarily consist of hydro-electric projects, with the existing steam projects (about 400,000 kilowatts) available for standby purposes. There is a distinct possibility that some additional steam power will be required by that time to maintain sufficient power supply to meet loads.

[fol. 646] Q. Have you studied the Nez Perce Project under conditions representative of the initial operating period?

A. Yes. I have studied the Nez Perce Project under two possible methods of operation during the initial period.

Q. Please describe these two methods.

A. The first type of operation analyzed is on the basis of coordinated operation in which the Nez Perce Project would be designed to meet loads with full use of stream flow and reservoir capacity during the critical period on the Columbia River now assumed to be 1936-37. Under coordinated operation it is assumed that outside this critical period extending from September 16, 1936 through April 15, 1937, supplemental energy and peaking capacity could be made available through exchange agreements with the Bonneville Power Administration and other non-Federal utilities to allow the Nez Perce Project to fill and hold its reservoir so that the reservoir would be full at each year on September 15.

The second type of operation analyzed is on the basis [fol. 647] of ultimate integration of the Nez Perce Project with all other projects in the Pacific Northwest, under the assumption that all resources in the Pacific Northwest will be operated on a fully integrated basis to meet all loads in the Pacific Northwest as if one utility owned and operated all resources to supply all loads.

Q. Do you believe the project will be operated under an ultimate integration basis?

A. The type of operation described under ultimate integration is the ideal type of operation from the standpoint of benefits to the Pacific Northwest region. Although there are benefits of this type of operation as compared to coordinated operation, the contractual difficulties associated with this type of operation are very complex and, in my opinion, will require extensive time to resolve. It is believed that these difficulties will be resolved in the future but at the present time form a bar to assurance that the project may be operated under the ultimate integration concept.

Detailed studies, however, have been made on this basis for 1967-68 and 1984-85 and it is believed that the basic value of the project for the year 1984-85 should be based upon such operation. Studies for the project for the year 1984-85 assume that such ultimate integration can be ac- [fol. 648] complished by that time.

Q. Do you believe the project will be operated on a coordinated operation basis?

A. Yes, I do. The type of operation described under coordinated operation can be achieved initially through the execution of a contract between the WPPSS and Bonneville providing for exchange of energy for reservoir filling and holding outside of Bonneville's historical critical-water period—at present extending from September 16, 1936 through April 15, 1937. We have discussed such a contract with the Bonneville Power Administration and Bonneville is willing to exchange such reservoir filling and holding energy on a one for one basis for energy from the

project to be provided during Bonneville's own reservoir drawdown period.

Q. Do you have any basis for believing that Bonneville enter into a contract with the WPPSS providing such exchange?

A. Yes, we have received a letter from Bonneville, giving Bonneville's views in this regard.

Q. I refer you to WPPSS Exhibit 37, for identification, and ask you if this exhibit is a copy of the letter from Bonneville Power Administration to which you refer.

A. Yes.

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[fol. 663] Q. How did you consider flood control opera-
[fol. 664] tions in your 30-year study?

A. Our studies of power output in April, May and June were based upon normal refill of the reservoir on approximately an equal basis.

Flood control operations were not reflected in our results. As a practical matter we would anticipate that the minimum pool elevation of 1388 would be maintained with full availability of 3,130,000 acre-feet of flood control storage for fill at the direction of the Army engineers.

Q. Is additional storage space available for flood control in the Nez Perce reservoir if required by the Army Engineers?

A. Yes, the project is designed for drawdown to elevation 1296.5 for flood control, providing a total of 4,700,000 acrefeet of usable storage for flood control.

Q. If this total flood control storage were drafted from the Nez Perce Project, what effect would it have on the ability of the project to supply dependable capacity?

A. The capability of the Nez Perce project with 10 units in operation at elevation 1296.5 would be 1,083,000 kilowatts. With a May peak load of 1,410,000 kilowatts, and with all 10 units in operation, the project would have to obtain 327,000 kilowatts of peaking capacity from other
[fol. 665] sources in order to carry its load.

Q. Under such circumstances, where would you anticipate obtaining such peaking capacity?

A. I would anticipate obtaining that additional capacity from the Army Engineers.

Q. What is the basis for this assumption?

A. The operation of the Nez Perce Project under coordinated operation with drawdown to elevation 1388 would allow the project to operate in a manner which would permit it to carry its load with the coordination agreement with the Bonneville Power Administration previously referred to. This would permit the availability of 3,130,000 acre-feet of usable storage for flood control without affecting the project's ability to supply its load. If additional storage for flood control were drafted at the request of the Army Engineers, the project could not continue to carry its load, and the load would accordingly have to be curtailed if outside peaking capability were not made available to it.

The January peaking capability of the projects controlled by the Army Engineers on Columbia and Snake Rivers is estimated at approximately 6,568,000 kilowatts. Assuming that this peaking capability was used to meet January [fol. 666] load of an equivalent amount, then the May peak of the load segment supplied by the Army Engineers' projects would be approximately 5,740,000 kilowatts. The May peaking capability of the Army Engineers' projects previously referred to is estimated at 6,428,000, leaving a surplus peaking capability of 688,000 kilowatts.

Use of this surplus peaking capability to obtain additional flood control storage appears to me to be both logical and justifiable.

It would be wasteful to require the Nez Perce Project to install additional units to obtain the peaking capability necessary to supply its loads under flood control operation when surplus exists elsewhere in the Pacific Northwest.

Q. What do you estimate the cost of this peaking capability from the Army Engineers would be?

A. It is believed that there would be no cost associated with the supply of this peaking capability. I would anticipate that the peaking capability would be exchanged for

the flood control benefits provided on the assumption that the organization responsible for obtaining the benefit provided would make the Nez Perce Project whole for the loss which would be occasioned by the Nez Perce Project operating to provide flood control benefits.

Q. Would the Nez Perce Project lose energy as a result [fol. 667] of drawdown for flood control?

A. Yes, it would.

Q. Would this loss be significant?

A. This loss of energy would not affect the ability of the Nez Perce Project to supply dependable capacity. It would affect to some extent the energy capability of the project during the relatively short time that the project is held below its normal elevation for flood control.

At such time as the project is operating in a hydro-steam system when energy has a definite steam replacement value this loss could be significant.

Q. Under such circumstances, how would you expect the Nez Perce Project to be made whole from an energy standpoint as a result of loss of energy for flood control operations at Nez Perce?

A. I would anticipate that loss of energy due to flood control operations within the 31,130,000 acrefeet of usable storage under coordinated operation would be a contribution of the Nez Perce Project to the region and would not be compensated for. I have assumed in my studies that any loss of energy occasioned by drawdown of the reservior beyond 3,130,000 acre-feet for flood control operations would be made up by the Corps of Engineers.

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[fol. 680] Q. Would you expect the operation under ultimate integration to change materially with a change in loads and resources?

A. Yes, I would. The basic use of the total storage drawdown of 4,700,000 acrefeet as indicated in the ultimate integration studies is economical only so long as there is surplus peaking capability in the Pacific Northwest to provide the peaking capability lost at Nez Perce as a result of

such drawdown. Studies which we have made indicate that in 1967-68, approximately 3 million kilowatts of surplus peaking capability will be available over peak periods to [fol. 681] meet peak reserve requirements and deficiencies resulting from excess drawdown. As the Pacific Northwest develops under an ultimate integrated concept, this surplus peaking capability will rapidly vanish. At such time as there is no more surplus peaking capability, reservoir drawdown at Nez Perce will require additional generator installations. The cost of these generator installations will have to be weighed against the energy advantages of heavy drawdown of the Nez Perce reservoir. In my opinion this will result in an economical drawdown of Nez Perce which is much less than indicated for 1967-68 conditions.

Q. Have you compared the results obtained from coordinated operation of the Nez Perce Project as compared to ultimate integration of the Nez Perce Project for the year 1967-68?

A. Yes, I have.

Q. Refer to WPPSS exhibit 53 for identification. Does this represent the results of your comparison?

A. Yes, it does.

Q. Please describe WPPSS exhibit 53 for identification and what it shows.

A. This exhibit, prepared under my supervision, is a summary comparison of power and energy output avail- [fol. 682] able as a result of construction of the Nez Perce Project under coordinated operation to that available under ultimate integrated operation.

It shows the comparison of at-site and downstream energy on a 20-year basis both annually and during the storage-control period. It also shows the comparison of at-site and downstream energy between types of operations during the 1936-37 critical period and a comparison of the January 31 peaking capability and minimum peaking capability between types of operations.

Q. What conclusions do you draw from this exhibit?

A. First, it can be seen that the different operations, which represent basically the different drawdowns of 3,-

130,000 acre-feet of storage in the case of coordinated operation and 4,700,000 acrefeet in the case of ultimate integrated operation, result in greater total energy attributable to the Nez Perce Project with lesser use of storage, averaging 1,181,000 kilowatts in the case of coordinated operation and 1,162,000 kilowatts in the case of ultimate integrated operation.

It is in the shaping of this energy to make it more usable in the load that the ultimate integrated operation shows a benefit. In the initial operation assumed to be in 1967-68, this shaping will be of value because of the [fol. 683] surplus peaking capability available in the Pacific Northwest as of that time. The reservoir operation assumed in ultimate integrated operation was based upon supply of requirements in the Pacific Northwest from hydro projects only. The resources to be placed in operation in order to allow supply of the estimated load will determine to a large extent the value of this shaping. As steam power projects are added to the Pacific Northwest power supply the value of reservoir shaping will be different than if the added resources were in the form of hydro-electric projects.

Furthermore, shaping the reservoir operation in accordance with ultimate integrated operation would reduce the peaking capability of the Nez Perce Project. Surplus peaking capability will be available in 1967-68 to make up this deficit, but as time goes on this loss of peaking capability would become important.

The basic value of the ultimate integrated operation over coordinated operation is in the 205,000 average MW of "nominal prime" capability that would otherwise be required to be installed in the Pacific Northwest to meet load. This basic value would be offset to some extent by the secondary energy required outside the critical 1936-37 period to allow this firm load to be carried, especially if [fol. 684] this secondary is marketable.

Thus, the value to the Pacific Northwest of use of the added storage represented by ultimate integrated operation as compared to coordinated operation in 1967-68 will

depend upon a number of factors which are not subject to precise determination.

With respect to power at-site, however, there is a loss of energy at-site over a 20-year period resulting from ultimate integrated operation—approximately 48,000 average kilowatts. There is also a loss in January peaking capability during a minimum year of 477,000 kilowatts and at minimum pool of 508,000 kilowatts. It is obvious, therefore, that contracts making the Nez Perce Project whole both from an energy and peaking standpoint would be necessary before ultimate integrated operation would become a reality.

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[fol. 707] Q. What storage at the Lower Canyon Project and the High Mountain Sheep Project did you determine to be necessary?

A. Our studies of the Mountain Sheep Lower Canyon alternative plan for the year 1984-85 maintained the same releases from the Crevice Project as were maintained in the Nez Perce study for 1984-85.

We regulated the Lower Canyon and High Mountain Sheep reservoirs to obtain the same residual steam plant requirements as were determined to be necessary under the Nez Perce plan. The resultant use of storage was the amount of 1,890,000 acrefeet for the Lower Canyon Project and 520,000 acrefeet for the High Mountain Sheep Project. Total use of storage from these two projects is 2,410,000 acre-feet compared to the 2,370,000 acre-feet of storage which was used in the Nez Perce studies.

Q. Did you make any studies of the output of the study area projects covering an extended period of water flows under the 1984-85 conditions and the alternative Mountain-Sheep Lower Canyon development plan?

A. Yes, I did.

Q. Please describe these studies.

A. Starting with the steam power resources determined [fol. 708] to be required for the year 1984-85, we again determined the residual load which would be imposed upon

the study area resources for each month of the 20-year period of water supply 1928-1948 in a manner similar to the procedure used in our Nez Perce studies for the study area projects for 1984-85. The rule curve for the Crevice Project as established in the Nez Perce studies was repeated in our alternative studies. We established a rule curve at Lower Canyon and at High Mountain Sheep based upon the first year operating rule as established in our studies of the critical period of water August 1929 through February 1932. In the development of this rule curve first draft of storage required in addition to that available from the Crevice Project was assumed to be from the High Mountain Sheep Project until the pool elevation of the High Mountain Sheep project was reduced to 1480 feet. Draft from Lower Canyon was then assumed to meet the balance of the requirements. Priority of fill was given to the Lower Canyon Project whenever possible.

Q. Did you spill any water during the 20-year study period from the Lower Canyon or High Mountain sheep reservoirs?

A. Yes, we spilled water from the Lower Canyon reservoir during eleven month of the 240-month period. We spilled water from the Mountain Sheep reservoir during [fol. 709] two months of the 240-month period.

Q. What was the average elevation of the Lower Canyon reservoir during this 20-year period?

A. The average elevation of the Lower Canyon reservoir was 1564 feet.

Q. What was the average elevation of the High Mountain Sheep reservoir during this twenty year period?

A. The average elevation of the High Mountain Sheep reservoir was 1488 feet.

Q. I refer you to WPPSS exhibit No. 59, for identification, and ask if this represents the results of your studies?

A. This exhibit, prepared under my supervision, summarizes the results of our studies for the alternative plan by years for the 20-year period of water flows studied.

Q. Please describe WPPSS exhibit 59 for identification.

A. This exhibit, which is similar to WPPSS exhibit No. 57 for identification, shows the annual output of each of the projects in the study area, including the downstream effects of the storage releases and refill of study area storage projects, with a column totaling the output of the study area projects for each year. The output of the Independent [fol. 710] Resources, Main System Hydro Resources and steam projects is also shown for each year with the total supply shown in the last column. At the bottom of the exhibit the 20-year average of resource output for each of the study area projects, the Independent Resources, Main System Hydro Resources and steam projects is also shown. Also shown at the bottom of the exhibit is the 31-month critical period average output for each of the resources mentioned above.

Q. How did you treat Hells Canyon encroachment in your determination of the High Mountain Sheep output in WPPSS Exhibit 59, for identification?

A. Hells Canyon encroachment was first deducted from the actual output of the High Mountain Sheep project and the remaining High Mountain Sheep project output is shown on this exhibit.

Q. What is the 20-year average output of the study area projects?

A. The 20-year average output of the study projects is 1,773,000 average kilowatts.

Q. Have you made any studies of the benefits and the costs of the study area projects under the alternative plan for 1984-85?

A. Yes, I have.

[fol. 711] Q. Please describe these studies.

A. The power value of the projects in the study area was determined by application of the power values of $11.77 per kilowatt to the January, 1932 peaking capability of each project, and of 2.90 mills per kilowatt hour to the average annual output of each project. The downstream

benefits outside the immediate study area projects were allocated to the three storage projects, Crevice, Lower Canyon and High Mountain Sheep in proportion to the maximum storage used from each reservoir during the critical period.

Flood control values were assigned to each project. Total values of each project were then determined. Annual costs of each project were taken from WPPSS exhibit 20 for identification.

The net value of each project was then determined by deducting the annual costs from the gross value. Benefits-to-cost ratios were computed by dividing the gross values of each project by the total annual charges of such projects.

Q. How did you determine the flood control value?

A. The flood control value was determined by computing the total storage necessary to reduce stream flows at Lower Canyon at 8,000 cfs and High Mountain Sheep to 2,000 cfs during the days when the natural flow at The [fol. 712] Dalles exceeded 800,000 cfs during the 1894 flood.

This period extended from May 26, through June 27 and was computed from basic data contained in Volume 1, plate 13 of the Army Engineers' 1958 report.

Total storage required was computed to be 6,180,000 acre-feet. The maximum usable flood control storage on the Snake River at the High Mountain Sheep Project was computed in the above manner to be 1,603,000 acre-feet.

The total flood control requirement on the Salmon River at the Lower Canyon Project, and above, was computed to be 4,577,000 acre-feet.

The flood control storage of 1,603,000 acre-feet was assigned to the High Mountain Sheep Project. The first 2,500,000 acre-feet of flood control storage required from the Salmon River was allocated to the Lower Canyon project on the assumption that the Lower Canyon Project would be constructed before the Crevice Project and would therefore obtain a priority position with respect to the flood control storage value.

The remaining 2,077,000 acre-feet of flood control storage required on the Salmon River was assigned to the Crevice Project. A value of $1.31 per acre-foot of flood control [fol. 713] storage was assigned to the useful flood control storage at each project and the flood control value applicable to each project was determined.

Q. I refer you to WPPSS Exhibit No. 60, for identification, and ask you if this is a summary of the results of your studies?

A. Yes, it is.

Q. Please describe this exhibit.

A. This exhibit, prepared under my supervision, contains 7 columns, one each for the Crevice Project, Freedom Project, Lower Canyon Project, High Mountain Sheep Project, China Gardens Project, and projects downstream from the study area, and one column for the totals of the other six.

The average kilowatts and average annual kilowatt-hours were determined from WPPSS exhibit 59 for identification.

The January peaking capability of each project was determined from studies which were made of reservoir operations over the 20-year water period, July 1928 through June, 1948.

Q. What is the total peaking capability and the average annual output of the study area projects?

A. Total peaking capability is 2,776,000 kilowatts and [fol. 714] the average annual output is 15,532,000,000 kilowatt-hours.

Q. What do you conclude from examination of the benefits-to-cost ratios as shown on WPPSS exhibit 60, for identification?

A. The benefits-to-cost ratios as shown, indicate that all projects in the study area are feasible additions to the hydro-electric supply of the Pacific Northwest.

The Mountain Sheep Project has the highest benefits-to-cost ratio and the China Gardens and Freedom Projects have the lowest benefits-to-cost ratio.

The China Gardens benefits-to-cost ratio is based upon the assumption that no encroachment payments would be required from China Gardens to the Mountain Sheep or Lower Canyon projects.

In the event that encroachment payments would be required from the China Gardens Project to the Mountain Sheep and Lower Canyon Projects, the benefits-to-cost ratio at China Gardens would be reduced.

Q. Have you made a comparison of the Nez Perce plan with the alternative plan for the 1984-85 conditions?

[fol. 715] A. Yes, I have.

Q. I refer you to WPPSS exhibit No. 61 for identification, and ask if this represents the results of your comparison?

A. Yes, it does.

Q. Please describe this exhibit.

A. This exhibit, prepared under my supervision, summarizes the results shown in the total columns of WPPSS exhibits Nos. 58 and 60, for identification, in the first two columns of the exhibit, with a third column showing the advantages of the Nez Perce plan over the alternative plan. It also contains a summary of capital costs obtain from WPPSS Exhibit No. 20, for identification.

Q. Please explain the numbers shown in parentheses in the third column of WPPSS exhibit No. 61 for identification.

A. The numbers shown in parentheses indicate an advantage to the alternative plan as compared to the Nez Perce plan. This advantage lies in the greater amount of January peaking capability available from the alternative plan than would be available under the Nez Perce Plan.

Q. Please explain the line entitled "Net Annual Value."

[fol. 716]. A. The net annual value as shown on WPPSS Exhibit No. 61, for identification, is determined by deducting the total annual charges from the annual total value.

Q. What is the significance of the Net Annual Value?

A. The net annual value is the true measure of the overall value of the study area projects.

It is, in effect, the added overall cost of providing the benefits provided by the study area projects from steam projects and replacement of flood damages in the event the study area projects are not constructed. Reference to WPPSS Exhibit No. 61, for identification, will show that the net annual value of the study area projects including the Nez Perce Project exceeds the net annual value of the study area projects including the alternative development by $5,700,000 annually, or approximately 18 per cent.

Q. What conclusions do you draw from this exhibit?

A. The plan of development of the Middle Snake River and the Salmon River including the Nez Perce Project [fol. 717] is approximately $85,500,000 less than the investment cost of the plan of development including Mountain Sheep and Lower Canyon projects.

The annual charges of the development of the Middle Snake River and the Salmon River including the Nez Perce Project are approximately $5,600,000 less than the annual charges of the plan of development including Mountain Sheep and Lower Canyon projects.

The plan of development of the Middle Snake River and the Salmon River including the Nez Perce Project is, therefore, superior to the plan of development, including the Mountain Sheep and the Lower Canyon projects.

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[fol. 1100] Testimony of R. Wayne Lincoln, Consulting Engineer.

Q. State your name, residence address and your occupation.

A. I am R. Wayne Lincoln, I live in Seattle, Washington at 4812 East 45th Street. I am a civil engineer.

Q. Where are you presently employed?

A. I am self employed as a consulting engineer. I retired from the U.S. Corps of Engineers on March 31, 1959.

* * * * * * *

[fol. 1105] Q. Are you familiar with the applications and proposals of Pacific Northwest Power Company and the

Washington Public Power Supply System for development of the Middle Snake River under study in these proceedings?

A. Yes, I was retained by the Department of Conservation to review the proposals of both applicants with respect to power routing and electrical power output from a system and individual plant standpoint.

Q. Please describe what work you have completed in that capacity.

A. In addition to study of both proposed developments, I have analyzed the anticipated power output of the alternative plans for development of the Middle Snake River and Lower Salmon River as proposed by Washington Public Power Supply System and Pacific Northwest Power [fol. 1106] Company and I have computed plant efficiencies based upon information including power data suggested by the applicants.

Q. Please identify exhibit 12 offered by the intervenor, Department of Conservation of the State of Washington.

A. Exhibit 12 offered by the intervenor, Department of Conservation of the State of Washington, is the graphic presentation of the efficiency study which I have compiled, comparing plant efficiencies of each storage plant in the proposed plans of development included in the applications under study in these proceedings.

Q. What criteria have you used in computing plant efficiency curves for the various plants indicated in the same exhibit 12 which you have just identified?

A. I have utilized power data submitted by the applicants themselves which were computed from detailed monthly power studies by selecting representative pool levels and using the designated tailwater elevations.

The Pacific Northwest Power Company power studies used were for the 1967-68 system dated December 19, 1959. It is assumed that the characteristics were identical for the 1984-85 studies. The 1984-85 manual studies were used for the Washington Public Power Supply System efficiencies.

[fol. 1107] Data for the Corps studies A-1 and B-1 were also computed but not shown. Their efficiencies are quite high for heads above 85 per cent and then dropped off rapidly for lower heads.

Q. What conclusions can be drawn from the efficiency curves portrayed in exhibit 12 which you have just identified and described?

A. It will be noted that the resulting efficiencies used by the Washington Public Power Supply System closely agree for their projects but vary appreciably from those used by Pacific Northwest Power Company. Pacific Northwest Power Company's overall plant efficiencies are appreciably lower for heads below 90 per cent of total head, but are roughly comparable for the higher heads.

Q. You have stated that you analyzed anticipated power output of the alternative plans of development as proposed by Washington Public Power Supply System and Pacific Northwest Power Company. Please state what, in your opinion, would be the power capabilities of the High Mountain Sheep plan of development proposed by Pacific Northwest Power Company and the Nez Perce plan of development proposed by Washington Public Power Supply System.

A. I have tabulated on Exhibit 13 offered by the Department of Conservation of the State of Washington, [fol. 1108] the power output of the two plans for levels of development up to 1985, which is the time all projects of either plan are assumed constructed.

For outputs of High Mountain Sheep and Nez Perce at the 1967-68 level of development I used data provided by the respective applicants. At the 1984-85 level of development I have used data from Washington Public Power Supply System's exhibits 58 and 60 since I believe they are the most realistic.

Q. In view of your experience and background and your studies of the proposed alternative plans of development, what do you believe are the most significant reasons for the variation in computed power output capabilities of the two systems as portrayed in exhibits of Pacific

Northwest Power Co. and Washington Public Power Supply System?

A. Power output varies to a minor degree in the different studies due to non-uniform treatment of plant efficiencies; penstock losses, non-productive losses, overlapping of pools, and storage manipulation.

With the identical heads and stream flows that pertain, the output of the two plans should be comparable in the years 1984-85. The Pacific Northwest Power Co. claim to an advantage of output results primarily from the exclu- [fol. 1109] sion of the upper Salmon River plants of Crevice, Freedom and White Bird.

The usable storage capacities in the plans have been compared. There is a half million acre feet more storage available in the High Mountain Sheep plan than in the Nez Perce plan if all storage is drawn down to the maximun proposed. However, most studies did not draw down to these limits because of excessive loss of capability and energy and the reduction of efficiency of Francis turbines at such excessive drawdowns. This loss in efficiency would be particularly important if turbines were used with the characteristics similar to those used in Pacific Northwest Power Company's studies. Exhibit 12 shows that for a 50 per cent drawdown the efficiency would drop to 75 per cent.

In the Corps A-1 study storage was drawn down to a total of 5,512,000 acre feet in March 1932. This storage could have been obtained in the Nez Perce plan by drawing the Nez Perce reservoir down to a degree less than proposed by Pacific Northwest Power Company for Lower Canyon. With Crevice constructed the drawdown proposed by Pacific Northwest Power Company would be particularly undesirable. Nez Perce would seem to have an appreciable advantage by storing flows of both the Salmon and Snake [fol. 1110] Rivers.

Nonproductive losses have not been honored in either Washington Public Power Supply System or Pacific Northwest Power Company studies. This appears to be unwise

in the early stage of planning. If the losses are 500 cfs as used in Corps of Engineers studies, the advantage to Nez Perce would be about 20 MW.

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[fol. 1111] Testimony of DOUGLASS C. NORTH, Ph.D., Professor of Economics, University of Washington.

Q. Please state your name, address and occupation.

A. I am Douglass C. North, 10023 Vinton Court, Seattle, Washington, Economist.

Q. Please summarize your academic background in the field of Economics.

A. B.A. in 1942, University of California.

Ph.D in Economics 1952, University of California.

Q. Please describe briefly your experience and background as an economist.

A. I served as Assistant Professor of Economics at the University of Washington from 1951 to 1956; Associate Professor of Economics, University of Washington from 1956 to 1960; and Professor of Economics at the University of Washington this year (1960: I am Acting Director of the Institute for Economic Research, University of Washington, Research Associate, National Bureau of Economic Research 1956-57 and Visiting Associate Professor, Stanford University 1957.

I received an Auxiliary Research Award, Social Science Research Council in 1959 which was published in leading national and international economic journals. In addition, I have prepared many articles which have been published [fol. 1112] in academic and professional journals throughout the United States.

Q. Describe briefly your experience in benefit-cost analysis.

A. I have undertaken several studies of benefit to cost of extending navigation on the upper Columbia and Snake River system. In the course of this, I reviewed the economic literature on benefit cost analyses and the develop-

ment of the conceptual framework by government agencies and testified before the Board of Review, Corps of Engineers in 1959.

Q. Are you familiar with the plans for development of the Middle Snake and Salmon Rivers proposed by Pacific Northwest Power Company and Washington Public Power Supply System in these proceedings?

A. Yes I was asked by the Department of Conservation of the State of Washington to analyze benefits and costs of the alternative projects for development of the Middle Snake.

Q. What values and facts common to the Nez Perce and High Mountain Sheep plans have you used in computation of the ratio of benefits to costs for each project?

A. I have used the cost estimates and flood control benefits prepared by Mr. Thomas and the power output [fol. 1113] figures suggested by Mr. Wayne Lincoln.

In addition, I have assumed the sequence of development outlined by Mr. Truman Price, which is in general conformity with the stated intentions of Pacific Northwest Power Company and Washington Public Power Supply System.

Since China Garden has a low benefit-to-cost ratio and is truly marginal to the system, I have assumed that it will not be constructed until 1985. Therefore, I assumed completion of Nez Perce or High Mountain Sheep in 1967-68, alternative lower Canyon in 1980 and the remainder of both plans in 1985.

Q. Please identify exhibit 14 submitted by the Department of Conservation of the State of Washington.

A. Exhibit No. 14 is my compilation of the benefit-cost ratios for Nez Perce Dam and High Mountain Sheep Dam, assuming completion of both as alternatives in the fiscal year of 1967-68.

Q. Indicate what statistics and schedules which you, as an expert and an economist, consider appropriate and have used as the bases for your compilation of exhibit 14 which you have just identified.

A. I have applied the annual charges for each project taken from Washington Public Power Supply System exhibit No. 20 which conform with Federal Power Commission [fol. 1114] technical Memorandum No. 1. Payments for flow regulation, taxes and Federal Power Commission licenses were excluded.

However, Mr. Thomas' figures for total project investment were used in my compilations which were $366 million for Nez Perce and $235 million for High Mountain Sheep. These figures exceed those of Mr. Thomas because I have included a figure of interest during construction which amounts to 11.25 per cent of the total project investment for the five year construction period. This is a realistic figure for the net cost of capital during this period.

Finally, debt service consisting of a 4½ per cent interest charge or an overall debt service of 5.06 per cent was used. This was calculated above the total investment figures developed by Mr. Thomas cited above. His interest rate appears to be a realistic appraisal of the price of capital for such projects.

No allowance has been made for costs to the salmon and steelhead fishing resources. Since there are clearly costs involved, these figures should be accordingly modified to take into account the losses that will result in each project.

The power benefits are those developed by Mr. Lincoln using Federal Power Commission power prices designed to maximize the system power benefits. The flood control [fol. 1115] benefits are those developed by Mr. Thomas using an incremental approach which is in conformity with benefit-to-cost analysis—rather than using a flat figure as the Corps of Engineers has done.

Q. Please summarize your determination of benefit cost ratios for the two projects assuming completion of both in the fiscal year 1967-68.

A. The benefit-cost ratio for Nez Perce is 2.32 to 1 compared to a figure for High Mountain Sheep of 2.03 to 1.

If alternatively we calculate annual benefits as a percentage of total investment cost for each of the projects Nez

Perce comes to 15.5 per cent and High Mountain Sheep comes to 13.9 per cent.

If, alternatively we calculate the net benefits of each project (i.e. annual benefits minus annual cost) as a percentage of total investment cost, the figure for Nez Perce is 8.8 per cent and for High Mountain Sheep is 7 per cent.

Q. Please identify exhibit 15 submitted by the Department of Conservation of the State of Washington.

A. Exhibit 15 submitted by the Department of Conservation of the State of Washington is an analysis of the value of economic benefits that would be foregone if High Moun- [fol. 1116] tain Sheep is constructed in 1968 and Lower Canyon is deferred until 1980.

Q. Please summarize the conclusions which, in your opinion, are to be drawn from exhibit 15 offered by the Department of Conservation of the State of Washington.

A. The difference between the annual net benefit figures of Nez Perce and High Mountain Sheep is $15,916,400. This is the annual net benefits which will be foregone by constructing High Mountain Sheep rather than Nez Perce in 1967-68. On the realistic assumption that Lower Canyon would not be completed until 1980 then the cumulative net benefits foregone by constructing High Mountain Sheep rather than Nez Perce would be approximately $190 million. This assumes a constant net benefit figure for each project which may be slightly modified but the overall differences would not be greatly changed by making annual adjustments of the figures.

When the costs to the fishery resource are introduced there will be a reduction in these figures for the obvious reason that the costs to this resource by construction of Nez Perce will exceed the cost to this resource by construction of High Mountain Sheep. Indeed the annual net benefit figure of $15,916,400 is perhaps a good yardstick against [fol. 1117] which to estimate the difference in cost of the fishery resource between Nez Perce and High Mountain Sheep. If this net difference in cost to the fishery resource

now exceeds $15,916,400 then the High Mountain Sheep project would by economic criteria be considered superior to Nez Perce.

Q. Please identify exhibit 16 submitted by the Department of Conservation of the State of Washington.

A. Exhibit 16 is my compilation of benefit-cost ratio of the lower Canyon Dam assuming completion in 1980 and the combined benefit-cost ratios of the Nez Perce Dam as compared to High Mountain Sheep and Lower Canyon in 1980.

Q. Please explain the method of computation you have used in development of Exhibit 16.

A. The annual costs of Lower Canyon were estimated in the same way as those in exhibit 1 for Nez Perce and High Mountain Sheep. The total investment cost was taken from Mr. Thomas' study as $205,600,000—including 11.25 per cent interest charge during construction.

The power benefits of Lower Canyon are those from Mr. Alspaugh's testimony on behalf of Pacific Northwest Power Company project for the year 1975 since none were available for 1980.

The flood control benefits are those of Mr. Thomas on the assumption that High Mountain Sheep plus Lower [fol. 1118] Canyon would provide about the same benefits as Nez Perce. The figure is somewhat higher than it would be if it was calculated as incremental to High Mountain Sheep rather than simply the difference between Nez Perce and High Mountain Sheep.

Costs and benefits for Nez Perce and High Mountain Sheep are assumed the same in 1980 as in 1967 while actual power benefits would likely change, nevertheless it should not significantly alter the net difference between the alternatives.

If we compare the net benefits of each system as done in Exhibit No. 2 there would be a net difference in favor of Nez Perce over High Mountain Sheep and Lower Canyon of $2,020,000 annually.

If we assume that all the other projects are completed in 1985, then the net benefits foregone between 1980-1985

by constructing High Mountain Sheep and Lower Canyon rather than Nez Perce are $10,000,000.

The net benefits foregone between 1967-1968 and 1985 would be approximately $200,000,000 by constructing the High Mountain Sheep system rather than the Nez Perce system.

The figures for Lower Canyon exclude any costs to the fishery resource and should be ultimately modified to take [fol. 1119] into account the costs that will be incurred by net losses of this resource.

Q. Please identify Exhibit No. 17 submitted by the Department of Conservation of the State of Washington.

A. Exhibit No. 17 is my compilation of the benefits to cost ratio of the entire proposed plan of development of Nez Perce versus High Mountain Sheep in 1985.

Now, in my compilation of Exhibit No. 17 I have used the annual power figures derived from Mr. Wayne Lincoln's estimates.

The flood control figures with the entire system developed are reduced to the Corps of Engineers figure of $1.31 per acre foot and the effective storage assumed the same as in Washington Public Power Supply System Exhibits Nos. 58 and 60.

The annual costs are the same as in Washington Public Power Supply System exhibit No. 20, except for Nez Perce, High Mountain Sheep and Lower Canyon where the figures were derived from new estimates prepared by Mr. Thomas.

No allowance has been included for losses to the fishery resources.

Q. On the basis of your studies what would be the ratio [fol. 1120] of benefits to costs of the entire Nez Perce System and the High Mountain Sheep System as proposed by the applicants in these proceedings for the year 1985?

A. The benefit to cost ratio of the Nez Perce system is 1.85/1 and that of the High Mountain Sheep System is 1.68 to 1.

Q. Please summarize your conclusions with reference to the ratio of benefit to costs as applied to the two projects and state to what extent they are in conformity with benefit to cost procedures.

A. First, the ratio of benefits to costs are clearly in favor of the Nez Perce plan of development as indicated in Exhibits Nos. 14, 15 and 16.

The assumptions made in my compilation of Exhibits 14, 15 and 16 offered by the Department of Conservation of the State of Washington with respect to the order of construction of interest rates, incremental benefits and other aspects of the projects are in conformity with benefit cost analysis procedures.

Secondly, as an economist estimates beyond 1985 are of little, if any, value because of the uncertainty of relative costs, prices, the development of technological substitutes, [fol. 1121] and so forth.

Finally, from an economist's viewpoint, the relevant alternatives are really Nez Perce vs. High Mountain Sheep.

The inclusion of a series of marginal projects in the 1985 system deserve little weight in making the choice between the alternatives today.

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[fol. 1502] Testimony of WILFRID A. FROGGATT, for the Commission Staff.

Q. Will you please state your name, residence, and occupation?

A. Wilfrid A. Froggatt, 95 Marietta Drive, San Francisco, California, Civil Engineer.

Q. Will you state by whom you are employed and in what capacity?

A. I am employed by the Federal Power Commission as Engineer-in-Charge of Licensed Projects Work of the Bureau of Power in the San Francisco Regionel Office.

Q. Please state briefly your education?

A. I was graduated from the San Francisco Polytechnic High School in 1922, and I received a Bachelor of Science degree in Civil Engineering in 1927 from the University of California, Berkeley, California.

Q. Are you a registered professional engineer?

A. Yes, sir, I am a Registered Civil Engineer in the State of California.

Q. Please state your professional experience?

A. I have been employed by the Federal Power Commission as Engineer-in-Charge of licensed projects and cost work in its San Francisco Regional Office from March 1945 to date. My responsibilities include planning and supervising engineering studies made in the regional office rela- [fol. 1503] tive to our licensed projects activities. I make field and office investigations, studies, and reports on applications for preliminary permits and licenses for proposed hydroelectric projects.

My work also includes review of designs, quantities, and costs of proposed hydroelectric projects in the region. I am responsible for field inspections, reports, and recommendations on existing licensed hydroelectric projects, and on new licensed hydroelectric projects under construction or additions to existing projects, to assure that construction and operation are being carried out in accordance with the provisions of the federal licenses.

At the present time some 156 hydroelectric plants are supervised as to operation. I have had charge of the field supervision for the Commission of the construction of all the licensed projects in the region (west of the Continental Divide) during the past 15 years, involving 50 or more major hydroelectric plants totaling about 6,672,000 kilowatts of installed capacity. Currently some 15 major hydroelectric plants have been or are under construction in the region, totaling about 3,923,000 kilowatts of installed capacity. I am in charge of the collection and analysis of current factual, basic cost data covering the construction, maintenance, and operation of water power plants, fuel plants and [fol. 1504] transmission facilities in the region. Prior to 1948 I was Engineer-in-Charge of engineering work in connection with cost determination of licensed hydroelectric projects, involving the preparation of engineering reports

on the claimed cost of some 30 licensed hydroelectric projects. I direct investigations of unlicensed water power projects, including research on the navigation histories of streams in the region; and direct special studies of benefits resulting to hydroelectric projects from headwater reservoirs.

I was employed from September 1939 to March 1945 by the Federal Power Commission as Civil Engineer in its San Francisco Regional Office, in connection with investigations and reports on comprehensive hydroelectric power developments, and licensed projects work.

From December 1936 to September 1939 I was in the San Francisco Regional Office of the Federal Power Commission as Associate Civil Engineer and worked on water supply and power studies and reports for proposed hydroelectric developments; and on the preparation of reports and analyses of the claimed cost of various licensed projects.

From February 1930 to November 1931 and from April 1932 to December 1936 I was with H. L. Haehl, Civil Engineer, San Francisco, California, as Assistant Civil Engineer on office work and field work of investigating and [fol. 1505] developing hydraulic projects. From November 1931 to April 1932 I was at the Berkeley Steel Construction Company on structural details, and work involving cost estimate relative to bidding on steel construction.

From September 1927 to February 1930 I was employed by Fred H. Tibbetts, Civil Engineer, San Francisco, as Assistant Civil Engineer in connection with the investigation, development, and operation of irrigation and drainage districts and hydroelectric projects.

From May 1927 to September 1927 I was with the University of California under Professors R. E. Davis, S. T. Harding, and B. A. Etcheverry, as assistant on a building study, on concrete research, and on irrigation studies of the San Joaquin Valley, California.

Q. What studies and other preparations have you made in order to familiarize yourself with matters under consideration at this hearing.

A. I have made studies of the engineering features of the application for license for Project No. 2243 filed by Pacific Northwest Power Company with regard to the proposed High Mountain Sheep development on the Snake River; and of the application for license for Project No. 2273 filed by Washington Public Power Supply System with regard to the proposed development of the Nez Perce project on [fol. 1506] the Snake River. I have also made studies of other potential developments, i.e., the Lower Canyon and Whitebird projects on the Salmon River, and of the China Gardens project on the Snake River below the High Mountain Sheep and Nez Perce projects, in connection with studies of comparative plans for the development of the Snake River and tributaries between China Gardens and Hells Canyon Project No. 1971 on the Snake River and Freedom on the Salmon River. These projects are within the common reach described on page 5, Vol. 1, of the transcript.

I have reviewed and made use of reports and surveys of the U. S. Geological Survey applicable to my studies, as well as surveys, studies, and reports prepared by the U. S. Corps of Engineers and the U. S. Department of the Interior. I have reviewed data and reports furnished by the applicants and in the files of the Commission.

Particularly, I have made use of the report prepared by the Division Engineer, U. S. Army Engineer Division, North Pacific, to the Chief of Engineers, U. S. Army, dated June 1958, entitled "Review of H. D. 531, 81st Congress, 2nd Session, Water Resource Development of the Columbia River Basin." I have inspected the sites of the projects proposed by the applicants and I have examined the areas that would be occupied by the proposed structures.

[fol. 1507] I have also inspected the other dam sites on the Snake and Salmon Rivers. I have reviewed and studied

the geology reports prepared by the applicants for the sites of the proposed projects, as well as the reports by the Corps of Engineers, on the geology of the sites of the projects in the comparative plans. I have studied the exhibits and read the direct testimony of witnesses in this proceeding.

Q. Have you participated in studies of alternative plans for the development of the common reach of the Snake and Salmon Rivers as already referred to by you?

A. Yes.

Q. Are these plans covered by other exhibits of the applicants?

A. Yes. The plans studied are identical to those shown on PNPC Exhibit No. 3 and PNPC Exhibit No. 4. The staff refers to the High Mountain Sheep plan shown on PNPC Exhibit No. 3 as Plan A-1, and to the Nez Perce plan shown on PNPC Exhibit No. 4 as Plan B-1. The locations of the several projects in the two plans are also shown on PNPC Exhibit No. 1. The locations of the projects also are illustrated on WPPSS Exhibits Nos. 6 and 7.

Q. Are you familiar with the projects which comprise the plans shown on these exhibits?

[fol. 1508] A. Yes.

Q. Please name the projects of Plan A-1, the High Mountain Sheep plan as used in the staff studies?

A. High Mountain Sheep project with normal water surface elevation 1510 feet; Lower Canyon project at river mile 3.7, with normal water surface elevation 1595 feet; and China Gardens project with normal water surface elevation 945 feet.

Q. Please describe the projects in Plan A-1, the High Mountain Sheep plan as used in the staff studies?

A. The High Mountain Sheep project would be located on the Snake River at about river mile 189.2, and about one-half mile above the mouth of the Salmon River but about 2.5 miles below the Imnaha River. The left abutment would be in Oregon and the right abutment in Idaho. The project would include a variable radius concrete arch dam having

a maximum height of about 670 feet with a crest elevation of 1520 feet, and a crest length of about 1460 feet. The dam would create a reservoir extending about 58 miles up the river at normal pool elevation 1510 feet, to Idaho Power Company's licensed but unconstructed Hells Canyon project and would overlap the tailwater of that project by about 35 feet. The reservoir would have a surface area of about 17,300 acres at normal pool elevation 1510 feet. Total storage capacity at normal pool would be about 3,600,000 [fol. 1509] acre-feet, of which about 2,250,000 acre-feet would be usable for power and flood control at a drawdown of 173 feet.

The spillway, consisting of an ogee section, chute with training walls, and three Tainter gates 50 feet wide by 50 feet high, would be located on the right bank separated from the dam by a short thrust block section. The spillway with the crest at elevation 1460 feet, would be capable of discharging a flood of 245,500 cfs with pond at elevation 1517.5 feet, and eight 8.5-foot diameter low level sluices would be provided through the dam, and would furnish a combined flood discharge of 300,000 cfs. An initial minimum flood control pool elevation 1382 feet, the low level sluices would discharge 47,000 cfs and the discharge of four powerhouse units would be 18,000 cfs, for a total release of 65,000 cfs.

Two powerhouses would be located below the dam. Initially four units would be located on the Oregon side and three on the Idaho side. Ultimately each powerhouse would have five units for a total of ten units.

Water would be conveyed from gate-controlled power intakes to the powerhouses by means of 18-foot diameter steel penstocks, each unit having a separate intake and penstock. Estimates of capital costs and annual charges [fol. 1510] were made for initial installations of five and seven units considering no sunk cost for future units in either case.

Francis-type turbines and outdoor-type generators would be utilized. Each unit would be rated at 184,000 kva, 175,000 kw at 0.95 power factor, and would have a peaking capability of 200,000 kw. Two outdoor gantry cranes having a capacity of 700 tons each would be provided. A 345-kv step-up substation and an operators' colony would also be provided at the project.

Access to the project would be by means of a road to be constructed from the town of Imnaha, Oregon. (See FPC Exhibit No. 1)

The Lower Canyon project would be located on the Salmon River approximately 3.7 miles above its confluence with the Snake River. The project would include a variable radius, variable thickness concrete arch dam having a maximum height above the river bed of about 735 feet with crest at elevation 1605 feet and a crest length of about 1490 feet. It would create a reservoir 72.8 miles long with a gross storage capacity of 3,820,000 acre-feet at normal pool elevation 1595 feet. Normal drawdown of 325 feet (elevation 1270 feet) would provide 3,265,000 acre-feet for power and flood control. The powerhouse would be located on the left bank of the river immediately downstream from the dam. [fol. 1511] Crest elevation of the spillway located on the right bank, would be at elevation 1558 feet. The spillway would consist of an ogee section, chute with flip-type bucket, and three Tainter gates 50 feet wide by 37 feet high, would be separated from the dam by a short thrust block section. Spillway capacity at maximum pool elevation 1602.5 feet would be approximately 164,000 cfs and eleven 8.5-foot diameter low-level sluices would be provided through the dam and would furnish a combined flood discharge capacity of 245,000 cfs. The discharge of the low-level sluices plus the turbine discharge would be 61,000 cfs at minimum pool elevation 1270 feet.

The powerhouse would be located below the dam on the left bank, with four units installed initially and with provisions for a fifth unit and for an ultimate installation of

seven units. Water would be conveyed from the gate-controlled power intakes through the dam and to the powerhouse by means of 18-foot diameter penstocks. Trashracks, screens and individual hoists would be provided for each intake.

Estimates of capital and annual costs were made for installation of four units, considering no sunk cost for future units. Francis turbines and outdoor-type generators would be utilized. Each unit would have a name-plate rating of 175,000 kw (184,000 kva at 0.95 power factor) and a peaking capability of 200,000 kw.

[fol. 1512] A 345-kv step-up substation and an operators' colony also would be provided at the project. The switchyard would be located on the right bank of the river at elevation 1660 feet.

Access to the project would be by means of a road from the town of Winchester, Idaho. Approximately 26 miles of existing road would be improved and resurfaced, and about 15 miles would be new road for a total of about 41 miles. (See FPC Exhibit No. 1)

The China Gardens project, with normal water surface elevation 945 feet, would be located on the Snake River at river mile 172.5. The project would include a concrete gravity dam having a maximum height above river bed of about 158 feet with a crest elevation of 957.5 feet, and a crest length of 1500 feet. The reservoir at normal pool elevation 945 would extend about 16.7 miles upstream to the High Mountain Sheep site on the Snake River and would regulate peak power releases from upstream projects. The powerhouse would be an integral part of the dam, forming a part of the non-overflow section on the right bank.

The spillway would consist of an ogee section and a stilling basin on the left side. The crest would be at elevation 892.5 feet and would support five Tainter gates 50 feet wide by 52.5 feet high. The spillway would be capable [fol. 1513] of discharging a maximum flood of 500,000 cfs at maximum surcharge elevation 955 feet.

Water would be conveyed to the powerhouse through the gate-controlled power intakes. Capital and annual costs were calculated for installation of three units with no sunk cost for future units. Kaplan-type turbines and outdoor-type generators would be utilized. Each unit would be rated at 90,000 kva, 85,000 kw at 0.95 power factor with a maximum capability of 100,000 kw. An outdoor gantry crane having a capacity of approximately 500 tons with auxiliary hook would be provided. A 230-kv step-up substation and an operators' colony would be located at the project. The switchyard would be constructed on a bench on the right side of the river at elevation 930 feet.

Access to the project would be by means of 22 miles of existing road which would need improvement and 3 miles of new road, a total of 25 miles to Asotin, Washington. (See FPC Exhibit No. 1)

Q. Please name the projects of Plan B-1, the Nez Perce plan as used in the staff studies?

A. Nez Perce project with normal water surface elevation 1510 feet; Whitebird project at river mile 58.8, with normal water surface elevation 1575 feet; and China Gardens project with normal water surface elevation 920 feet. [fol. 1514-1515] Q. Please describe the projects in Plan B-1, the Nez Perce plan as used in the staff studies.

A. The Nez Perce project would be located on the Snake River at about river mile 186.2 and about two and one-half miles below the mouth of the Salmon River. The left abutment is in Oregon and the right abutment is in Idaho. At the present time access to the site is by riverboat from Lewiston, Idaho. No roads exist to the site area. The project would include a variable radius concrete arch dam with an ogee spillway at the right abutment. Total crest length of the dam would be about 1605 feet and crest height above river bed would be about 720 feet with crest at elevation 1520 feet. It would create a reservoir, at normal pool elevation 1510 feet extending about 61 miles upstream to Idaho Power Company's licensed but uncon-

structed Hells Canyon project and would overlap the tailwater of that plant by about 35 feet. Gross storage capacity at normal pool elevation 1510 feet would be about 6,600,000 acre-feet, of which 5,015,000 acre-feet would be usable at normal operating drawdown of 240 feet (to elevation 1270 feet). Provision would be made for ultimate maximum drawdown to elevation 1210 feet, which would provide 5,595,000 acre-feet of usable storage.

Crest elevation of the gate-controlled ogee spillway [fol. 1516] would be 1465 feet. Five Tainter gates 50 feet wide by 45 feet high would provide 380,000 cfs discharge at pool surcharge elevation 1517.5 feet. Outlet works, 20 in number, would be located through the center of the dam at two levels and would be controlled by gates and valves for flood control purposes. The combined discharge capacity of spillway and outlet works at surcharge elevation would be 500,000 cfs. At minimum flood control pool elevation 1270 feet the 20 low level sluices would discharge 94,000 cfs and combined with a discharge of 26,000 cfs through the powerhouse units would provide a total discharge of 120,000 cfs.

Water would be conveyed from the gate-controlled power intakes to the two downstream powerhouses by means of steel penstocks 25 feet in diameter, each serving two units except for one 18-foot diameter penstock which would serve one unit.

Provisions would be made for the ultimate installation of 17 units, 9 in the Oregon powerhouse and 8 in the Idaho powerhouse. Estimates of capital and annual costs were made for initial installation of 11 units without sunk costs for future units. Francis turbines and outdoor-type generators would be utilized. Each unit would be rated at 174,000 kva, 165,000 kw at 0.95 power factor and would have a peaking capability of 190,000 kw. Two outdoor gantry cranes, each having a capacity of 700 tons would be provided. A 230-kv and 345-kv step-up substation and [fol. 1517] operators' colony also would be provided at

the project. The switchyard would be located on a bench on the Idaho side.

Access to the project would be by road from Asotin and would require improvement of 22 miles of existing roads and 17 miles of new road, a distance of about 39 miles. (See FPC Exhibit No. 1)

The Whitebird project would be located on the Salmon River at about river mile 58.8. The project would include a concrete gravity dam having a maximum height above river bed of about 160 feet with crest at elevation 1585 feet, and a crest length of 975 feet. The reservoir at normal pool elevation 1575 feet would extend 14.7 miles upstream, or about 4 miles beyond the Freedom dam site. The pool would be operated at about a 10-foot drawdown, providing weekly pondage but no flood control storage space. The powerhouse would be an integral part of the dam, forming part of the non-overflow section adjoining the overflow spillway.

The spillway would consist of an ogee section and a stilling basin on the left side of the river. The crest would be at elevation 1537.5 feet, and would support four Tainter gates 50 feet wide by 37.5 feet high. The spillway would be capable of discharging about 245,000 cfs at maximum [fol. 1518] surcharge elevation 1582.5 feet.

Water would be conveyed to the powerhouse through the gate-controlled power intakes. Capital and annual costs were prepared for installation of one unit without sunk costs for future units. Kaplan-type turbines and outdoor-type generators would be utilized. Each unit would be rated at 55,000 kva, 52,000 kw at 0.95 power factor and would have a peaking capability of 60,000 kw. An outdoor gantry crane having a capacity of about 275 tons would be provided. A 230-kv step-up substation and an operators' colony would be located at the project. The switchyard would be constructed on a bench on the right side of the river at elevation 1550 feet.

Access to the project would be by local roads from U. S. Highway 95, which would be relocated. (See FPC Exhibit No. 1)

The China Gardens project, with normal water surface elevation 920 feet, would be located on the Snake River at river mile 172.5. The project would include a concrete gravity dam having a maximum height above river bed of about 133 feet with crest at elevation 932.5 feet, and a crest length of 1350 feet. The reservoir at normal pool elevation 920 feet would extend 13.7 miles upstream to the Nez Perce project, and would be operated to reregulate peak [fol. 1519] power releases from upstream projects. The powerhouse would be an integral part of the dam, forming a part of the non-overflow section on the right bank.

The spillway would consist of an ogee section and a stilling basin on the left side. The crest would be at elevation 867.5 and would support five Tainter gates 50 feet wide by 52.5 feet high. The spillway would be capable of discharging a maximum flood of 500,000 cfs at maximum surcharge elevation 930 feet.

Water would be conveyed to the powerhouse through the gate-controlled power intakes. Capital and annual costs were made for installation of three units, without sunk costs for future units. Kaplan-type turbines and outdoor-type generators would be utilized. Each unit would be rated at 69,000 kva, 65,000 kw at 0.95 power factor and would have a peaking capability of 75,000 kw. An outdoor gantry crane having a capacity of 450 tons would be provided. A 230-kv step-up substation and an operators' colony would be located at the project. The switchyard would be constructed on a bench on the right side of the river at elevation 910 feet.

Access to the project would be by means of one mile of new road from the Nez Perce project access road. (See FPC Exhibit No. 1)

Q. What design layouts and cross-sections did you use [fol. 1520] in preparing cost estimates for the several projects in Plan A-1 and Plan B-1?

A. After review of engineering designs and layouts, I used the Ebasco engineering drawings shown in PNPC Exhibit No. 16 as a basis for quantity and cost estimates for each of the projects in the comparative studies of Plans A-1 and B-1, except that I used the Ebasco arch dam design and layout for the Nez Perce project instead of the gravity dam layout shown in PNPC Exhibit No. 16.

Q. I refer you to FPC Exhibit No. 2, the design drawings for a Nez Perce arch dam project. Who prepared these drawings?

A. These drawings were prepared by Ebasco, and show an alternative arch dam design for the Nez Perce site, referred to by Witness Bonin on page 33 of his prepared testimony.

Q. Did you make quantity estimates for each of the projects of the comparative plans?

A. Yes; and I found that in most cases my quantities checked the quantities shown by Ebasco in PNPC Exhibit No. 16, and in its estimate of the arch dam alternative for the Nez Perce Project. (FPC Exhibit No. 2)

Q. Did you make cost estimates for the various projects in the comparative Plans A-1 and B-1?

[fol. 1521] A. Yes, I did.

Q. Did you campare your estimates with those made by Ebasco and as shown on PNPC Exhibit No. 16?

A. Yes.

Q. Did you compare your estimates with those made by Ebasco and as shown on PNPC Exhibit No. 16?

A. Yes.

Q. What did you find?

A. I found that while my analyses did not check with the Ebasco estimates item by item, yet my total construction cost for hydraulic production plant after overhead and indirect cost was reasonably close to that shown by Ebasco at the level called "Total Construction Cost (ex interest)" for each of the projects in the comparative plans.

Q. Did you use the Ebasco "Total Construction Cost (ex interest)" for each of the projects in the comparative Plans A-1 and B-1?

A. Yes, with the qualification that I considered these costs to be as of January 1, 1960 price levels in accordance with the engineering items of agreement as shown on page 7, Vol. 1, of the transcript, and further, that in each case I utilized the cost for hydraulic production plant only by omitting FPC Accounts Nos. 342 and 343 covering the step-[fol. 1522] up substation of transmission plant and the respective amounts for indirects, overheads, escalation, contingencies and omissions.

Q. Did you prepare capital cost estimates for the various projects of Plan A-1 and Plan B-1?

A. I did prepare such cost estimates.

Q. I direct your attention to FPC Exhibits Nos. 3, 4, 5, 6, 7 and 8, showing capital costs for the projects in Plan A-1 and Plan B-1. Do you have these exhibits before you?

A. Yes.

Q. Did you direct and supervise the preparation of these exhibits?

A. Yes.

Q. Explain briefly these exhibits?

A. Exhibit No. 3 shows the capital cost estimate for the High Mountain Sheep project for hydraulic production plant only, and for a number of units installed, and in each case without any provision for future units. Interest during construction was computed by using a rate of 4.50 percent per annum. Exhibits Nos. 4, 5, 6, 7 and 8, show information similar to that shown on FPC Exhibit No. 3, with respect to Lower Canyon project at mile 3.7 to normal water surface elevation 1595 feet, China Gardens project with normal water surface elevation 945 feet, Nez Perce project with normal water surface elevation 1510 feet, [fol. 1523] White bird project with normal water surface elevation 1575 feet, and China Gardens project with normal water surface elevation 920 feet, respectively.

Q. Please explain how the estimated capital cost of each project was obtained?

A. The capital cost of each project is the cost of hydraulic production plant as obtained from Ebasco estimates contained in PNPC Exhibit No. 16 and modified so as to remove the cost of all provisions for future units, and then by adding the cost to install additional units as required. After the construction cost for the several installations was obtained, interest during construction was then added to obtain the capital cost of the hydraulic production plant. To this cost was added the capital cost of fishery facilities, and the capital cost of other necessary facilities. The total of these items as shown by the exhibits is the total capital cost.

Q. How was interest during construction computed?

A. Interest during construction was estimated on the cost of the hydraulic production plant before interest during construction, estimated at 4.50 percent per annum for a period equal to one-half of the estimated construction period, which was considered to terminate at the midpoint of the time required for the installation of the total num-[fol. 1524] ber of units for each installation at the project.

Q. What construction period did you use for each project?

A. Construction periods were used as shown on the exhibit developing the capital cost for each project.

Q. What is the basis of the allowances for the cost of fish facilities which you included in your capital cost estimates?

A. The allowances for fish facilities for the High Mountain Sheep and Nez Perce projects were based upon the cost of such facilities as obtained from the respective applicants, but modified to the extent deemed necessary in each case. In the case of the Lower Canyon and China Gardens projects, I estimated allowances based upon the best information I could obtain.

Q. What does your item of other costs include?

A. This item includes allowances for the capital cost of protecting the Hells Canyon development of Project No. 1971 from reservoir overlap by the downstream project, for the capital cost of recreational facilities, and for other miscellaneous facilities that may be needed.

Q. I refer you to FPC Exhibit No. 9, Summary of Capital Costs for Comparative Plan Studies. Did you direct and supervise the preparation of this exhibit?

[fol. 1525] A. Yes.

Q. Please explain this exhibit?

A. FPC Exhibit No. 9, in three sheets, shows summaries of capital costs of hydraulic production plant of projects in the comparative plan studies, without provisions for future units, and for interest rates of 2.50 percent, 4.50 percent, and 6.50 percent per annum.

Q. I now refer you to FPC Exhibits Nos. 10, 11, 12, 13, 14 and 15, Estimated Annual Costs for projects in Plan A-1 and Plan B-1. Did you direct and supervise the preparation of these exhibits?

A. Yes.

Q. Please explain briefly FPC Exhibit No. 10 showing annual costs for the High Mountain Sheep project?

A. This exhibit shows the total capital cost and total annual costs for the High Mountain Sheep project hydraulic production plant for the various units assumed installed. The annual costs include annual fixed charges on the capital cost of production plant, the annual operation and maintenance cost of powerplants, large reservoirs, fish facilities, and other facilities. Therefore, the annual cost shown on this exhibit is for total hydraulic production plant, only, and does not include the capital or annual cost for step-up substation or other transmission plant that would be neces-

[fol. 1526] sary to transmit the power output of the project to load center. Annual fixed charges applicable to project investments, exclusive of step-up and other transmission facilities, include allowances for interest, amortization, interim replacement, and insurance, expressed as a percent of the capital cost of the project. For the first 50

years these fixed charges for hydraulic production plant are: interest 4.50 percent; amortization 0.56 percent; interim replacements 0.20 percent; and insurance 0.10 percent; a total of 5.36 percent. Amortization is computed on a 50-year period with 4.50 percent interest on a sinking fund basis. At the end of the 50-year period, it is assumed that the original investment of the project would be completely amortized. Fixed charges beyond that stage would then be those required for replacements and insurance, estimated to be 0.50 percent.

Q. Please explain how the annual operation and maintenance charges for the project shown on FPC Exhibit No. 10 were obtained?

A. Annual charges for operation and maintenance are based upon the installed capacity of projects, and are obtained from data currently used by the Bureau of Power. These charges are considered conservative and to include allowances for operation and maintenance of the large dams [fol. 1527] and reservoirs, recreational facilities, and other miscellaneous expenses. Operation and maintenance charges for fish facilities that will be needed were adopted in the amounts shown as being reasonable allowances.

Q. Will you please explain why the annual cost of step-up substation facilities was not included in your exhibits?

A. The annual cost of step-up substation facilities has been computed by staff witness Lisk.

Q. Does the explanation that you have given apply to FPC Exhibits Nos. 11, 12, 13, 14 and 15, which cover the estimated total annual costs of hydraulic production plant for the other projects in Plan A-1 and Plan B-1 projects?

A. Yes. These exhibits show annual costs of projects computed on the basis of an interest rate of 4.50 percent per annum.

Q. Did you compute annual costs for projects assuming interest rates of 2.50 and 6.50 percent also?

A. Yes, I did. FPC Exhibit No. 16, prepared by me in three sheets, shows summaries of annual costs of hydraulic production plant of projects in the comparative plant stud-

ies without provisions for future units, and for interest rates of 2.50 percent, 4.50 percent, and 6.50 percent per annum.

Q. What annual rates for fixed charges did you use?

[fol. 1528] A. The rate for 4.50 percent interest has been explained previously and amounts to 5.36 percent. Similarly the rates for 2.50 percent and 6.50 percent interest are 3.83 percent and 7.09 percent, respectively, for the first 50 years of project operation. After 50 years the rate is 0.50 percent.

Q. Mr. Froggatt, will you please summarize FPC Exhibits Nos. 3 through 16?

A. These exhibits give capital and annual costs of projects and which are used by the staff in the comparative studies of Plan A-1 and Plan B-1.

Q. Mr. Froggatt, have you made studies of economic feasibility of the High Mountain Sheep Project No. 2243 and the Nez Perce Project No. 2273 assuming financing and construction by the applicants in accordance with the respective applications?

A. Yes.

Q. Did you make quantity estimates for High Mountain Sheep Project No. 2243 and for Nez Perce Project No. 2273 based upon design drawings contained in the applications for licenses for these projects?

A. Yes, and I found that my estimates checked closely with the quantities used by each applicant.

Q. Did you make cost estimates for the High Mountain [fol. 1529] Sheep Project No. 2243 and for Nez Perce Project No. 2273?

A. Yes, I did.

Q. Did you compare your estimates with those made by Ebasco and Harza Engineering Company for applicants and as shown by PNPC Exhibit No. 13 and by WPPSS Exhibit No. 19, respectively?

A. Yes.

Q. What did you find?

A. I found that while my analyses did not check with applicants' estimates item by item, yet my total construction cost for hydraulic production plant was reasonably close to those shown by Ebasco and Harza Engineering Company at the total cost level before interest during construction for hydraulic production plant.

Q. Did you use the Ebasco and Harza Engineering Company cost estimates before interest during construction for High Mountain Sheep Project No. 2243 and Nez Perce Project No. 2273, respectively?

A. Yes, with the qualification that I considered these costs to be as of January 1, 1960, price levels in accordance with the engineering items of agreement as shown on page 7, Vol. 1, of the transcript, and further, that I utilized the cost for hydraulic production plant only by omitting FPC Accounts Nos. 342 and 343 for the step-up [fol. 1530] substation of transmission plant and the associated amounts for indirects, overhead, escalation, contingencies and omissions.

Q. Did you prepare capital cost estimates for the High Mountain Sheep Project No. 2243 and for the Nez Perce Project No. 2273?

A. Yes, I did prepare capital cost estimates for these projects, in the form of FPC Exhibits Nos. 17 and 18.

FPC Exhibit No. 17 shows the capital cost estimate for the High Mountain Sheep Project No. 2243 assuming financing and construction by Pacific Northwest Power Company. Starting with PNPC Exhibit No. 13, cost for hydraulic production plant only before interest during construction, I computed and added interest during construction estimated at 5.50 percent per annum for a period equal to one-half of the estimated construction period. To these costs were added the capital cost allowances for fishery facilities and other items.

Q. Will you please state your estimate of the capital cost of the High Mountain Sheep Project No. 2243 assum-

ing financing and construction by Pacific Northwest Power Company?

A. My estimate of capital cost for the hydraulic production plant for High Mountain Sheep Project No. 2243 [fol. 1531] assuming financing and construction by Pacific Northwest Power Company amounts to $190,652,000.

Q. Explain FPC Exhibit No. 18?

A. This exhibit shows the capital cost estimate for the Nez Perce Project No. 2273 assuming financing and construction by Washington Public Power Supply System. Starting with the WPPSS Exhibit No. 19 cost for hydraulic production plant only before interest during construction, I computed and added interest during construction at rates of interest of 4.50 percent, 5.00 percent, and 5.50 percent per annum, assuming all monies raised in advance of construction and that funds would be re-invested at 3.00 percent during the construction period. To these costs were added capital cost allowances for fishery facilities and other items.

Q. Will you please state your estimate of the capital cost of the hydraulic production plant for the Nez Perce Project No. 2273 assuming financing and construction by Washington Public Power Supply System?

A. My estimate of capital cost for the hydraulic production plant for Nez Perce Project No. 2273 assuming financing and construction by Washington Public Power Supply System, amounts to $400,867,000 assuming interest at 4.50 percent, $413,007,000 assuming interest at 5.00 percent, [fol. 1532] and $425,914,000 assuming interest at 5.50 percent.

Q. Did you make studies of the total annual costs of High Mountain Sheep Project No. 2243 and Nez Perce Project No. 2273 assuming financing and construction by Pacific Northwest Power Company and Washington Public Power Supply System, respectively?

A. Yes, sir, I did, in the form of FPC Exhibits Nos. 19 and 20.

Q. Please describe Exhibit FPC No. 19?

A. FPC Exhibit No. 19 is the estimate of the annual cost of the High Mountain Sheep Project No. 2243 assuming financing and construction by Pacific Northwest Power Company. The annual costs include annual fixed charges on the hydraulic production plant, annual operation and maintenance costs on the power plant, reservoir, fish and other facilities, administrative and general expense, and the annual cost of transmission. As shown, the annual fixed charges applicable to the project production investment total 9.77 percent.

Q. How did you obtain the estimated capital cost of substations and transmission plant, and the annual cost of substations and transmission plant shown on FPC Exhibit No. 19?

A. These estimates of cost were obtained from staff Witness Lisk.

[fol. 1533] Q. What is your estimate of the annual cost of the High Mountain Sheep project, including step-up substation and transmission plant?

A. The estimate of total annual cost for this project, including step-up substation and transmission plant, amounts to $27,937,000.

Q. Will you now explain FPC Exhibit No. 20?

A. FPC Exhibit No. 20 is the estimate of the annual cost of the Nez Perce Project No. 2273 assuming financing and construction by Washington Public Power Supply System. The items shown and the explanation of each would be substantially the same as given for FPC Exhibit No. 19, except that annual costs on this exhibit are shown for three rates of interest, namely, 4.50, 5.00 and 5.50 percent. Again, the estimated capital cost of the step-up substation and transmission plant, and the annual cost of substation and transmission plant shown on FPC Exhibit No. 20 were obtained from staff Witness Lisk.

Q. What is your estimate of the annual cost of the Nez Perce project including transmission?

A. The estimate of the annual cost of the Nez Perce project including transmission amounts to $37,433,000 assuming 4.50 percent interest, $40,346,000 assuming 5.00 percent interest, and $43,474,000 assuming 5.50 percent [fol. 1534] interest.

Q. I direct your attention to FPC Exhibits Nos. 21 and 22. Did you prepare these exhibits?

A. Yes.

Q. Will you explain FPC Exhibit No. 21?

A. This exhibit is a study of the economic feasibility of High Mountain Sheep Project No. 2243 assuming construction and operation by Pacific Northwest Power Company. It is based upon an evaluation at load center of the dependable capacity and average annual energy output of the project as compared to the total annual cost of the project at load center, as obtained from the previous FPC Exhibit No. 19. On the basis of the dependable capacity and average annual energy output of the project, and the annual value and cost as shown on this exhibit, the excess of annual value over annual cost is indicated, as well as the ratio of benefits to costs.

Q. Are you responsible for all the figures shown on this exhibit?

A. No. I obtained the dependable capacity and the percent of transmission losses for capacity and energy outputs and the unit values of power from Witness Lisk; and I obtained the average annual energy output from Witness Meadowcroft.

[fol. 1535] Q. What is the excess of annual value over annual cost of the High Mountain Sheep project at load center, as shown on FPC Exhibit No. 21?

A. The excess of annual value at load center is shown to be $13,148,000.

Q. What is the ratio of benefits to costs, as shown on FPC Exhibit No. 21?

A. The ratio of benefits to costs is 1.47 to 1.00.

Q. Will you explain briefly FPC Exhibit No. 22?

A. This exhibit is a study of the economic feasibility of Nez Perce Project No. 2273 assuming construction by

Washington Public Power Supply System. It is based upon an evaluation at load center of the dependable capacity and average annual energy output of the project as compared to the total annual cost of the project at load center, as obtained from the previous FPC Exhibit No. 20 assuming interest rates of 4.50 percent, 5.00 percent, and 5.50 percent. On the basis of the dependable capacity and average annual energy output of the project, and the annual values and costs as shown on this exhibit, the excess of annual value over annual cost is indicated, as well as the ratio of benefits to costs, for each of the three interest rates.

Q. Are you responsible for all the figures shown on this exhibit?

[fol. 1536] A. No. I obtained the dependable capacity and the percent of transmission losses for capacity and energy outputs and the unit values of power from Witness Lisk; and I obtained the average annual energy output from Witness Meadowcroft.

Q. What is the excess of annual value over annual cost of the Nez Perce project at load center, as shown on FPC Exhibit No. 22?

A. The excess of annual value at load center is shown to be $13,131,000 for 4.50 percent interest rate, $11,427,000 for 5.00 percent interest rate, and $9,579,000 for 5.50 percent interest rate.

Q. What is the ratio of benefits to costs as shown on FPC Exhibit No. 22?

A. The ratio of benefits to costs is 1.35 for 4.50 percent interest rate, 1.28 for 5.00 percent interest rate, and 1.22 for 5.50 percent interest rate.

* * * * * * *

[fol. 1565] Testimony of ALLAN J. MEADOWCROFT, for the Commission Staff.

Q. Will you state your name, address, and present employment?

A. My name is Allan J. Meadowcroft. I reside at 43 Jordan Avenue, San Anselmo, California. I am employed by the Federal Power Commission in its San Francisco

regional office at San Francisco, California. My present position is designated as Hydraulic Engineer (Power Investigations). Functionally, I am Engineer-in-Charge of the River Basin Group of the San Francisco regional office.

Q. Mr. Meadowcroft, what is your educational background and professional experience?

A. My background and experience are detailed in my statement, which is as follows:

Qualifications of Allan J. Meadowcroft, Supervising Hydraulic Engineer (Power Investigations), Federal Power Commission, San Francisco Regional Office.

Education

October 1922 to December 1926.

Student of Civil Engineering at Stanford University, California; graduated with AB degree in Civil Engineering, June 1926.

October 1930 to December 1931; January 1932 through July 1933.

[fol. 1566] Graduate student in Civil Engineering at Stanford University, California; specialized in engineering mechanics, structural design, and hydraulics of models; granted degree in Civil Engineering, requiring two years of graduate studies and thesis, July 1933.

Professional and Honor Societies.

Fellow, American Society of Civil Engineers.

Phi Beta Kappa, and Sigma Xi.

Columbia Basin Inter-Agency Committee.

Chairman, Power Planning Subcommittee.

Member, Water Management Subcommittee.

Professional Experience

Prior to graduation from University in 1926.

Surveyor on construction layout work at Don Pedro Dam, Melones Dam, Exchequer Dam; and on preliminary surveys for Carquinez Bridge, California.

January 1927 to July 1928.

Resident engineer, Turlock Irrigation District, Turlock, California; on Don Pedro powerplant addition.

August 1928 to September 1929.

Engineering draftsman, Hetch Hetchy Water Supply Department of City and County of San Francisco.

September 1929 to July 1930.

Junior engineer, Division of Water Resources, State of California, Sacramento, California.

[fol. 1567] August 1930 to September 1930.

Assistant Hydraulic Engineer, U. S. Bureau of Reclamation, Sacramento, California.

October 1930 to December 1931.

Acting instructor in Civil Engineering, Stanford University, California.

January 1932 to December 1932.

Instructor in engineering and mathematics, Modesto Junior College, Modesto, California.

January 1932 to July 1933 (See Education).

September 1933 to January 1939.

Instructor in engineering and mathematics, Canal Zone Junior College, Division of Schools, The Panama Canal, Balboa Heights, Canal Zone.

January 1939 to March 1939.

Structural Designer and Assistant Hydraulic Engineer, The Panama Canal, Balboa Heights, Canal Zone. Structural engineer with Panama Canal Office Engineer.

April 1939 to April 1942.

Associate Engineer, Bureau of Engineering and Water Power, Federal Power Commission, Washington, D. C. Analyzed multiple-purpose river basin projects in New England area.

April 1942 to May 1943.

Civil Engineer, Bureau of Water Power, Federal Power [fol. 1568] Commission, Washington, D. C. Processed applications for licenses for hydroelectric projects; made studies of the operation and maintenance of licensed projects, safety and adequacy of hydraulic structures, feasibility of hydroelectric projects; and prepared license instruments in accordance with Federal Power Act.

May 1943 to July 1945.

Hydraulic Engineer, Licensed Projects Division, Federal Power Commission, Washington, D. C. In charge of Special Analysis Section of Licensed Projects Division. This section made engineering and economic studies involving hydrometeorology, flood estimates, safety and adequacy of hydroelectric power structures; foundation treatment; and feasibility of power projects.

July 1945 to February 1948.

Hydraulic Engineer, Atlanta Regional Office, Federal Power Commission. In charge of River Basins and Licensed Projects Group which (1) independently and in cooperation made studies of the hydroelectric resources of the region; and (2) made periodic inspections of licensed projects in the region.

March 1948 to August 1956.

Hydraulic Engineer, San Francisco Regional Office of FPC. In direct charge of the hydroelectric investigations [fol. 1569] of the rivers and projects of the Columbia River Basin and adjacent areas.

August 1956 to date.

Supervising hydraulic engineer (power investigations), Engineer-in-Charge of River Basin work, San Francisco Regional Office of FPC. This group processes hydraulic, power production, cost-allocation and economic justification problems regarding existing and proposed Federal projects, investigates special problems regarding proposed licensed

projects as assigned, and carries out other investigations as assigned.

Q. Mr. Meadowcroft, what is your responsibility as technical witness for the Federal Power Commission?

A. I have laid out certain schemes, or plans, for comparing the projects proposed by the applicants for Project 2243 and Project 2273, respectively; and using the results of studies of Witnesses Wilfrid A. Froggatt and James L. Lisk, together with studies of my own, I arrived at certain conclusions regarding comparative annual costs of alternative hydroelectric developments for the Middle Snake and Lower Salmon reaches of the Salmon and Snake Rivers.

Q. Mr. Meadowcroft, did other agencies contribute toward your studies?

[fol. 1570] A. Yes, the North Pacific Division of the Corps of Engineers, U. S. Army, provided me with data on flood control benefits attributable to the reservoirs of the alternative developments, and in cooperation with the applicant for Project 2243, they provided system power regulation studies. Later, the applicant for Project 2273 also provided me with system power regulation studies.

Q. Will you please describe in a general way your plans for comparing the developments of the two applicants?

A. The Nez Perce project, proposed by applicant for Project 2273, the High Mountain Sheep project proposed by applicant for Project 2243, involve the development of the reaches of the Snake and Salmon Rivers extending from the China Gardens site at mile 172.5 of the Snake River to headwaters of the licensed Hells Canyon project at normal pool elevation 1,683 (about mile 247.3 of the Snake River), and extending to the headwaters of the proposed Freedom project at normal pool elevation 1,780 (about mile 69.3) on the Salmon River.

These reaches of the Snake and Salmon Rivers may be developed alternatively by two principal schemes of development which I have designated the A-1 scheme and the

B-1 scheme. Proceeding upstream, the A-1 scheme would consist of a China Gardens, the High Mountain Sheep, and the Hells Canyon projects on the Snake River; and [fol. 1571] the Lower Canyon, and Freedom projects on the Salmon River.

Likewise, proceeding upstream, the B-1 scheme would consist of a different China Gardens project, and the Nez Perce and Hells Canyon projects on the Snake River, and the Whitebird and Freedom projects on the Salmon River.

Q. Do you characterize the projects of the alternative schemes?

A. Yes, I do. I call the High Mountain Sheep and Lower Canyon projects of the A-1 scheme, and the Nez Perce project of the B-1 scheme, the alternative storage developments; or the principal alternatives. The China Gardens project, I call the afterbay reregulating project. The Whitebird project is a run-of-river project which completes the development of the head above the B-1 scheme between the Nez Perce pool and Freedom tailwater. The Freedom projects of Schemes A-1 and B-1 are identical projects; likewise, Hells Canyon is the same in each scheme. They are introduced into the alternative schemes because the head loss at these projects, due to the backwater of each alternative on them, may differ somewhat, thus affecting the comparative power output of the alternative schemes.

Q. Mr. Meadowcroft, are the reaches of the Snake and Salmon Rivers occupied by the projects you have just described referred to as the "common reach" in the stipula- [fol. 1572] tion of the May 16, 1960, prehearing conference found in Volume 1 of the transcript?

A. Yes.

Q. Are there any further developments on the Snake and Lower Columbia Rivers directly associated with the "common reach" alternative developments?

A. In all schemes that I have studied, I have assumed that the upstream licensed Project No. 1971 on the Snake River would be common to both schemes and operated identically in all comparisons. I have assumed the Crevice

storage project upstream in certain studies of the alternatives. These, I will define later. I have assumed the four downstream Lower Columbia projects in all studies of the alternative projects, and certain groupings of the five Lower Snake projects, which I will define later. Inasmuch as the storage releases of the alternative projects affect the power output of the downstream projects, these projects are considered in the comparative analyses of the alternatives.

Q. Can you refer me to certain exhibits which more specifically define the common reach, other upstream Snake and Salmon River projects, and the downstream projects, which you have referred to?

A. Yes, I can. I refer you to PNPC Exhibit Nos. 3 and [fol. 1573] 4, which define the projects I have referred to. These charts also show normal pool elevations I have used in my studies. PNPC Exhibit No. 3, designated as "High Mountain Sheep Plan," is the development I designate as Scheme A-1. PNPC Exhibit No. 4 designated as "Nez Perce Plan" the development I designate as Scheme B-1.

Q. Which are the common reach projects on these charts?

A. They are the projects outlined in red plus the Freedom and Hells Canyon projects.

Q. Are there other exhibits that present pertinent data on the common reach projects used in your schemes?

A. Yes. I refer you also to Tables 2 and 3 of PNPC Exhibit 18 which provide pertinent data on the projects of my A-1 and B-1 schemes, respectively. Table 2 is designated "Pertinent Data for High Mountain Sheep Plan," and Table 3 is designated "Pertinent Data for Nez Perce Plan." In these two tables I have adopted as pertinent to my studies the data on lines 1 to 9, inclusive, under heading "General"; on lines 10 to 13, inclusive, under heading "Storage"; and data on lines 23, 24, and 26, inclusive, under heading "Other Date."

Q. The pertinent data on the common reach projects that you have designated have not defined the powerplant in-

[fol. 1574] stallations of the projects. Can you define these installations?

A. Yes; but first, I must give further description of my studies. I will present two types of economic studies or comparisons. In one set, all major alternatives; i.e., Nez Perce and China Gardens, on one hand; and High Mountain Sheep, Lower Canyon, and China Gardens at another pool elevation, on the other, are all assumed in service in 1968. For the economic comparison of this set, the installations I have assumed for 1969-70 conditions, not 1968, and 1987-85 conditions are those designated on Tables 4 and 5 of PNPC Exhibit 18 under headings "1968 System" and "1985 System," respectively.

A second set of my studies involves placing High Mountain Sheep in service in 1967-68, and Nez Perce or Lower Canyon in service in 1977-78. In this set of studies, High Mountain Sheep is given a five-unit installation during the 1968 to 1978 period, having the same size units as in the first set of studies. In this second set of studies, all 1984-85 installations of common reach projects are as described for the first set.

Q. What installation did you assume for Whitebird project?

A. I assumed 1 unit of 52,000 kw name-plate, as shown for Whitebird, on lines 14, 15 and 16 of Table 3, PNPC [fol. 1575] Exhibit 18.

Q. Will your exhibits define the installations you use in connection with each of your studies, as you present them?

A. Yes, they will.

Q. Have you completed your designation of the pertinent data describing the common reach alternative projects used in your studies?

A. I have. Further data, if necessary, will be described when the specific studies are presented.

Q. In your answer to a previous question, you indicated that your power and economic studies were related to 1969-70 conditions and to 1984-85 conditions. Will you further explain these references?

A. I'll be glad to. The Federal Power Commission, in analyzing the economics of proposed hydroelectric developments generally, specifies a 50-year economic life. In the case of the proposed Nez Perce and proposed High Mountain Sheep projects, assuming an in-service date of 1967-68, this "life" would extend to 2017-18. My personal task in this assignment related to determination of comparative power outputs, computation of comparative power costs, introduction of flood control benefits into the analysis, and determination of comparative net cost. To do this, I prefer [fol. 1576] to estimate these items at the beginning and midpoints of the economic life, and give consideration to the end-point—this, I refer to as a 3-spot analysis.

Q. Will you explain how you accomplished this?

A. Yes, in the earlier stage of the investigation, arrangements were made with the applicant for Project 2243, and with North Pacific Division of the Corps of Engineers, for system power output studies at a so-called 1968 level of development, and at a 1985 level, respectively.

The first level assumed all the existing and under construction projects in service, plus others as given in the May 16, 1960, prehearing conference stipulations; and the second level is that assumed by the Army in its 1958 Review Report of the Columbia Basin as the level at which all major economic multiple-purpose projects will have been completed and placed in service. This level is typified by the Army's IV-H and IV-J systems which basically is the system of recommended projects as designated in the 1958 report.

These system studies, as provided by the Army to our office, gave a basis for estimating power output of the alternative systems at the beginning of the 50-year period and near the midpoint of the economic life (1993).

Q. Are they the power regulation studies to which the [fol. 1577] applicants for Projects 2243 and 2273 stipulated at the prehearing conference held May 16, 1960, in Washington, D. C.?

A. They are. The stipulation is in item 3.

Q. Can you refer me to an exhibit or exhibits which describes the systems to which the applicants stipulated?

A. Tables 6 and 7 of PNPC Exhibit 18 give data on the 1968 alternative systems; and Tables 10 and 11 of PNPC Exhibit 18 give data on the 1985 alternative systems.

Q. Are the projects and outputs of the alternative systems at each of the specified levels; that is, at 1968 and at 1985, the same?

A. They are except for the alternative projects of the common reach, and the outputs of downstream projects which differ only as affected by storage releases of the common reach storage projects, and the outputs of Hells Canyon and Freedom which differ only as affected by the backwater overlap of the alternative downstream projects.

Q. Did you assume a projected system at the end of the 50-year economic life of the alternative projects?

A. Yes. I assumed that no additional hydroelectric projects would be constructed following 1985, except for the addition of Crevice in some studies.

[fol. 1578] Q. Do the systems you have used in your comparative studies give full development of all head on the Snake River below Weiser, and on the Salmon River below the headwaters of the Freedom project?

A. Yes.

Q. Does this mean all projects below Weiser, and below the headwaters of the Freedom project are assumed in service in 1967-68?

A. No, it does not. In some of my studies I assume Nez Perce, Lower Canyon, and China Gardens placed in service in 1977-78; and Crevice, Freedom, and Whitebird placed in service in 1984-85. I will discuss these schedules at a later time.

Q. You stated previously that you introduced flood control benefits into your economic analyses.

A. Yes, I did. I requested the North Pacific Division Engineer to evaluate the flood control benefits attributable to the alternative storage developments of the common reach for the 1968 and 1985 levels using Columbia Basin

system studies consistent with the power regulation studies I have just described.

Q. Can you refer me to an exhibit showing the results of these Army studies?

A. Yes, page 10 of PNPC Exhibit 19 shows a copy of the [fol. 1579] table of flood control benefits furnished by the Army to the San Francisco Regional Office.

Q. I show you FPC Exhibit 23 consisting of four sheets, two of which are charts, and the other two are tables. Was this exhibit prepared under your direction?

A. Yes, it was.

Q. What is the purpose of the exhibit?

A. Its purpose is to show the relative nature of the variations and the effects of the variations in the two basic alternatives, as shown by the studies of the Army and each of the applicants.

Q. What does the chart show?

A. It shows variations in basic dimensions of two alternative plans for development of the common reach as shown by the A-1 or A-2 studies of the Army and each of the two applicants.

Q. What do the tables show?

A. They show the variations in 1984-85 power output attributable to each alternative development in the common reach as shown by the Army, applicant for Project 2243, and applicant for Project 2273. These variations are attributable mostly to the variations shown in the pertinent data portion of the table, and to those shown by the charts, and also to variations in efficiencies assumed by the applicants, Army, and FPC.

[fol. 1580] Q. Do you have a similar table for the 1967-68 level?

A. No, only PNPC data are available for the comparative studies at the 1968 level; that is, studies of Nez Perce and China Gardens as in B-1; and High Mountain Sheep, Lower Canyon, and China Gardens as in A-1.

Q. Mr. Meadowcroft, I show you FPC Exhibit 24 which consists of a Table 1, Table 2, Table 3, and Table 4. Was this exhibit prepared under your supervision?

A. Yes, it was.

Q. What is the purpose of this exhibit?

A. This exhibit combines into one source of reference the power output data of several alternative Pacific Northwest systems which I have used as a basis of four comparative economic studies, designated "O", "P", "Q", and "W", of the alternative developments of the common reach. Tables 1, 2, 3, and 4 show, respectively, back-up system power output summaries used in my comparative economic studies of the alternative schemes A-1 and B-1, which I have designated "O", "P", "Q", and "W", respectively. Comparative economic studies "O", "P", and "Q" are summarized in FPC Exhibit 25, and comparative economic study "W" is given in FPC Exhibit 27.

Q. What is the background of the system power studies [fol. 1581] summarized in this exhibit?

A. The output data of the systems are based on two sets of basic power regulation studies of integrated Pacific Northwest hydroelectric power systems. One set is for 1967-68 conditions, and the other is the 1984-85 system which are defined in item 3 of the Washington, D. C., stipulations of May 16, 1960. The two 1967-68 systems were made by the applicant, Project 2243, at the request of the San Francisco office of the FPC and represent systems comprised of the Pacific Northwest existing, under construction, certain other projects, plus one or the other alternative developments of the "common reach," as have been designated as the A-1 and B-1 systems.

The two 1984-85 systems in their original form were prepared by the North Pacific Division of the Corps of Engineers for the FPC. The regulation study which is summarized in this exhibit is the 1960 Army study, with adjustments in the dimensions and regulation of the com-

mon reach reservoirs as proposed by the applicant for Project No. 2243, and used by me for the purpose of my comparative studies. The two regulation studies for the 1984-85 level I have also previously designated as Systems A-1 and B-1.

Q. Will you please refer to Table 1 of this FPC Exhibit 24?

[fol. 1582] A. I have it.

Q. What does this table show?

A. It shows by similar and parallel columns the power outputs of the A-1 and B-1 systems at 1969-70 for Comparison "O".

Q. Why did you use 1969-70 instead of 1967-68?

A. By using 1969-70, I was able to utilize previously prepared staff estimates of the usable energy (columns 5 and 11 of Table 1); and the use of this year for economic comparison of the schemes during initial operations is as adequate as 1967-68.

Q. Why are data for certain projects not listed?

A. As I previously explained, these data are for the Pacific Northwest existing, under construction, and certain other projects as stipulated to in Volume 1 of the Transcript, plus one or the other of the common reach alternatives. Whitebird could well be a common reach alternative along with Nez Perce in System B-1, but our studies showed it uneconomical unless the inflows were regulated by Crevice. It was therefore replaced by less expensive alternatives since it appears unlikely that Crevice will be constructed by 1969-70.

Q. Do you have any further explanations of this table?

A. Yes, I do. I wish to point out that, except for the [fol. 1583] common reach plants, the installed capacities of all hydro plants of both B-1 and A-1 systems are identical. I also point out that except for the common reach and downstream plants, the power output of the hydro plants of the B-1 and A-1 systems are the same. I also point out that the total outputs of the hydro systems (line 26, Table 1) are

not sufficient to meet load and reserve requirements (line 31), and additional power (line 28 or 29) is required to meet the requirements.

I also point out that the difference in the outputs of the common reach plants (line 12) plus the difference in the outputs of the downstream plants (line 23) gives a measure of the difference in the power benefits of the two alternative hydro developments of the common reach as of 1969-70.

Q. Please explain the derivation of the load requirement figures shown on line 31 of Tables 1, 2 and 3 of FPC Exhibit 24?

A. I based these data on the five-year period fiscal year power requirements shown on FPC Exhibit 29. I used Mr. Lisk's procedure for computing annual fiscal year requirements. I used reserve requirements provided by Mr. Lisk, and basic load shapes as stipulated in prehearing conference Exhibits 9 and 10.

Q. I notice the total system peaking capabilities on line [fol. 1584] 30, Table 1, are considerably in excess of the requirements on line 31. Does this indicate over-installation of capacity in the system?

A. I believe it does. This is the present condition of the Pacific Northwest hydro system, and it may continue for some time.

Q. Mr. Meadowcroft, will you now turn to Table 2 of FPC Exhibit 24, and describe it?

A. Table 2 is similar to Table 1 in form and in the data presented. It shows by similar and parallel columns the power outputs of the A-1 and B-1 systems at year 1984-85 for Comparison "P".

Q. Why did you select the PNPC 1984-85 regulation rather than the Army regulation as covered by the stipulation?

A. The Army 1984-85 study and the PNPC study are identical except for the dimensions and outputs of the projects of the common reach, and the outputs of the downstream projects which differ only because of difference in

storage releases from the common reach alternative storage projects.

The China Gardens project in the PNPC 1984-85 regulation is the same as that used in the 1969-70 regulation. Moreover, my check studies indicate that the pondage capacities of the PNPC China Gardens project for the A-1 and B-1 systems are consistent and appear to be adequately [fol. 1585] planned for the purpose of my studies. The Army's China Gardens project in the B-1 system appears to be undersized. Furthermore, the Army provided regulation data for the PNPC A-1 system, and, furthermore, I found the Army A-2 system, which is the regulation including High Mountain Sheep and Lower Canyon at mile 0.5 stipulated to on page 5, Volume 1, of the transcript, less desirable economically than the PNPC A-1 system. I therefore adopted the PNPC A-1 alternative over the Army's corresponding A-2 system.

Q. Do you have any further explanations of this table?

A. They are as previously described following the same question in regard to Table 1 of FPC Exhibit 24.

Q. I notice that the January 1932 peaking capabilities given in columns 6 and 12, on line 30 of Table 2, are not greatly in excess of the requirements shown on line 31.

Please explain this?

A. It means that the excess capacity shown by the 1969-70 system of Table 1 is estimated to no longer exist in 1984-85.

Q. Mr. Meadoweroft, will you please turn to and describe Table 3 of FPC Exhibit 24?

A. Table 3 is substantially the same as Table 2. It gives power output data for 1984-85 conditions assuming Crevice in service. Freedom and Whitebird are also included.

[fol. 1586] Q. Who made the power regulation studies for Crevice, Freedom, and Whitebird?

A. These studies were made under my supervision by the staff of our San Francisco office.

Q. Please describe the regulation studies?

A. We made a regulation study for the 31-month critical period August 1, 1929 to February 29, 1932, and for the near average runoff year, July 1, 1935 to June 30, 1936.

The regulation study for the critical period was of reconnaissance-type assuming the Crevice reservoir full at the beginning of the critical period, and empty at the end. Crevice was operated to secure as nearly uniform regulated outflow as possible during this period. The outputs of Freedom and Whitebird are based on the regulated flows from Crevice plus local inflow between Crevice and Freedom. Nez Perce in System B-1 and Lower Canyon in System A-1 were reoperated to account for the new inflows, and to secure uniform increase in outflow from Nez Perce, or Lower Canyon, substantially equal in amount to the Crevice usable storage spread uniformly over the 31 months of the critical period. The assumed operation of Crevice and Freedom are applied identically to both A-1 and B-1 systems, and the procedure of reoperation of Nez Perce of System B-1 and Lower Canyon of System A-1 is identical. Outputs of downstream plants were increased [fol. 1587] during the critical period due to the storage releases from Crevice, and the increments at these downstream plants are the same in both Scheme B-1 and Scheme A-1.

The regulation study of the average year 1935-36 was also of reconnaissance-type. A reoperation was made of Lower Canyon project in Scheme A-1 assuming Crevice storage and storage space used for regulation of the inflows to Crevice, and Lower Canyon storage and storage-space for regulation of the added inflows from the drainage area between Crevice and Lower Canyon. Monthly storage releases and flow withdrawals at Crevice were established at approximately 89 percent of the corresponding monthly storage releases and flow withdrawal in the basic 1984-85 A-1 operation study used in connection with Comparison "P", see Table 2 of FPC Exhibit 24. This percentage is the ratio of the drainage area at Crevice to that at Lower

Canyon. It was further assumed that the monthly releases of Lower Canyon in Study "Q"; i.e., the study with Crevice upstream, in this average year, would be identical to those of Study "P" (the study without Crevice upstream).

Thus was established a revised regulation of the Lower Canyon project with higher pool levels and higher power [fol. 1588] outputs, both attributable to Crevice. The revised outputs of Lower Canyon and the outputs of Crevice and Freedom are shown on Table 3 of FPC Exhibit 24. The average usable energy outputs of Middle Snake River plants and downstream plants are not changed.

The B-1 system was reoperated assuming identical transfer of storage operations from Nez Perce to Crevice, as from Lower Canyon to Crevice in the A-1 system study. The operation of Crevice in Comparison "P" is identical in both A-1 and B-1 schemes. Furthermore, making the same assumption as previously made for Lower Canyon, the monthly releases from Nez Perce in Comparison "Q", Table 3, are identical to those in Comparison "P", Table 2. Thus was established a revised regulation of Nez Perce with higher pool levels and higher power outputs, both attributable to Crevice. The new outputs of Scheme B-1, assuming Crevice, Freedom, and Whitebird, are shown on Table 3; and are on the same basis as those for Scheme A-1, also, on Table 3.

Q. Do you have any other remarks regarding Table 3 of FPC Exhibit 24?

A. Only to say, that except as to the portions I have just described, it is similar to Table 2.

Q. Mr. Meadowcroft, will you please refer to Table 4 of FPC Exhibit 24, Comparison "W", and explain it?

[fol. 1589] A. This exhibit provides an estimate of the power added to the Pacific Northwest integrated hydroelectric system by the High Mountain Sheep project during the 10-year period 1968 to 1978. It is used in connection with Economic Comparison "W", shown by FPC Exhibit 27, which evaluates benefits from the use of High

Mountain Sheep projects assuming it is placed in service in 1967-68, 10 years before the 1977-78 delayed date for either Nez Perce or Lower Canyon.

The table derives power benefits attributed to High Mountain Sheep project at year 1969-70 assuming it is first added to the Pacific Northwest existing and under construction systems. It shows also the power added by High Mountain Sheep to the 1984-85 system, and finally an interpolation is made to estimate the power added by High Mountain Sheep at the calendar year 1972, which is the midpoint of the 10-year period over which costs are to be estimated.

The estimates of the nominal prime added to downstream plants by storage releases at High Mountain Sheep are those estimated by applicant, Project 2243, and which were checked by the staff. Average usable energy added to downstream plants by High Mountain Sheep are based on estimates by FPC staff. Those of the downstream power added by the project to the 1984-85 system were obtained [fol. 1590] by use of "drop-out" studies provided by the North Pacific Division, Corps of Engineers, to the staff, and by the latter to the applicants.

The at-site generation of High Mountain Sheep for 1969-70 and for 1984-85 are based on studies of the applicant, Project 2243. Under both 1970 and 1985 conditions, a five-unit installation at High Mountain Sheep was assumed, and under both conditions the projects were assumed operated without the China Gardens reregulation. The adjustment to High Mountain Sheep output, due to overlap of Hells Canyon, line 2 of Table 4 of FPC Exhibit 24, was estimated by the staff.

The dependable peaking capacity shown on line 17 of Table 4 is based on the end of the critical period peaking capability, April for 1969-70 conditions and February for 1984-85 conditions, divided by the ratio of the estimated peak loads of April and February respectively, to the January peak load.

The power attributed to High Mountain Sheep project over the 10-year period 1968 to 1978 is estimated at 872 average mw of nominal prime, 617 average mw of usable energy, and 822 mw of adverse year peaking capability.

Q. Mr. Meadowcroft, I refer you to FPC Exhibit 25 consisting of Table 1 in 2 sheets, Table 2 in 2 sheets, Table 3 [fol. 1591] in 2 sheets, and Table 4 in 1 sheet. Was this exhibit prepared under your supervision?

A. Yes, it was.

Q. Will you in a general way explain the purpose of the exhibit, and give the basic assumptions you used?

A. This exhibit presents three economic comparisons of alternative developments of the common reach. In each of these comparisons, it has been assumed that High Mountain Sheep, Lower Canyon, and China Gardens of the A-1 scheme would be in service in 1967-68; and that Nez Perce, and its corresponding China Gardens project, would also be in service in 1967-68.

Each of the comparisons represents a specific condition of basin development. Each comparison provides comparative annual costs for three interest rates; i. e., 2½%, 4½% and 6½%, and the differences in these costs, of developing equal power in the common reach alternative Schemes A-1 and B-1, supplemented by such minor amounts of alternative hydro or fuel-electric power from outside the common reach area as is required to make the power output of each scheme equal. The alternative common reach schemes providing the equalized power output at least cost is considered the more economic scheme.

Annual costs of each alternative were credited with the [fol. 1592] annual flood control benefits it provides, and charged with the cost of such supplemental fuel-electric or hydroelectric power as was required to equalize the output of the alternative A-1 and B-1 schemes. Annual costs of the common reach power facilities, which were provided by Witnesses Froggatt and Lisk, are given for three rates of interest—2½%, 4½% and 6½%.

The unit annual cost of supplemental fuel-electric power were prepared by Witness Lisk, and the unit annual costs of supplemental hydroelectric power are taken from FPC Exhibit 26, which will be described later.

Q. Will you give a brief statement describing the three economic comparisons you made in FPC Exhibit 25?

A. The three economic comparisons I made, each at the three interest rates, I have designated Comparisons "O", "P", and "Q", and are as follows:

Comparison "O" gives the economic comparison of Scheme A-1 vs. B-1 under year 1969-70 conditions.

Comparison "P" gives the economic comparison of Scheme A-1 vs. B-1 under year 1984-85 conditions, without assuming Whitebird and Freedom in service, or upstream regulation by Crevice.

Comparison "Q" gives the economic comparison of Scheme A-1 vs. B-1 based on 1984-85 conditions, and as- [fol. 1593] sumes Whitebird, Freedom, and Crevice projects placed in service in 1984-85.

The above economic comparisons are given on Tables 1, 2 and 3 of FPC Exhibit 25, each with 2 sheets.

Q. Will you please refer to Table 1 in 2 sheets of FPC Exhibit 25, and explain the data on that table?

A. This table gives a comparison of the annual costs of Schemes A-1 and B-1 under conditions estimated for year 1969-70. I call this Comparison "O". You will note that annual costs are given for each of three interest rates, 2½%, 4½% and 6½%. The 1969-70 conditions are those of the existing and under construction Pacific Northwest system, and others as stipulated in Volume 1 of the transcript, plus the common reach alternatives shown on lines 8 through 15, column 1. The annual costs of the alternative common reach projects of the B-1 and A-1 schemes at the three different interest rates are shown in Columns 4 and 5, 7 and 8, and 10 and 11.

The differences in costs of the schemes, which is the primary purpose of the table, are shown in Columns 6, 9 and

12. The cost of Hells Canyon is not shown, since it is the same in both schemes, and thus does not affect the cost difference of the alternative A-1 and B-1 schemes.

To the costs of the common reach projects are added costs of supplemental hydroelectric facilities as are required to make the power output of both schemes equal in [fol. 1594] nominal prime output, usable energy, and dependable peaking capacity. The unit values of these supplemental hydroelectric power facilities are derived in FPC Exhibit 26. The amount of required supplemental facilities is derived on Sheet 2 of Table 1.

The A-1 and B-1 alternative storage projects of the common reach are each credited with the flood control annual benefits each produces, as estimated by the North Pacific Division, Corps of Engineers, and recorded on PNPC Exhibit 19, page 10.

The amounts shown in columns 6, 9 and 12, on line 31 are my estimates of the additional annual cost, under 1969-up conditions, that it would cost at the respective interest rates to produce equal power output using Scheme B-1 facilities (and the necessary supplement) as compared with Scheme A-1 facilities.

Q. Why did you use hydroelectric facilities rather than steam-electric facilities as the source of supplemental power?

A. At this year 1969-70, I estimate that hydro facilities for both energy and capacity will be available for purchase or construction; further, I estimate, as will be explained in connection with FPC Exhibit 26, that the values there derived are conservative and a reasonable estimate of prob- [fol. 1595] able next cheapest alternative hydro costs.

Q. Will you please turn to Sheet 2 of Table 1 of FPC Exhibit 25. What is the purpose of this tabulation?

A. Its purpose is to compute the supplemental power; i.e., nominal prime, usable energy, and dependable peaking capacity needed to make equal the outputs of Schemes A-1 and B-1, as shown on Sheet 1.

Line 11 gives the total outputs attributable to the common reach plants. These include at-site output plus the incremental output of the downstream plants. To the outputs shown on line 11, there are added the outputs of additional needed hydroelectric facilities, as shown by line 14, to obtain the equal outputs of nominal prime, usable energy, and dependable peaking capacity shown on line 15.

Q. Which items are transferred to Sheet 1 as a basis of the cost of supplemental hydroelectric facilities?

A. The usable energy item and the dependable peaking capacity items on line 14, columns 5 and 8, or 10 and 13. If a capacity item appears in both columns 8 and 13, the difference is transferred.

Q. Mr. Meadowcroft, please refer to Sheet 1 of Table 2 of FPC Exhibit 25, and explain the data on this table?

A. The data shown are in the same form as shown by [fol. 1596] Table 1, Sheet 1, for 1969-70 conditions. The economic comparison of Schemes A-1 and B-1 shown on this table, which I call Comparison "P", is representative of year 1984-85 conditions, somewhat near the middle of the payout period.

Q. What are the main differences between this Table 2 and Table 1 representing 1969-70 conditions?

A. The main differences are in the supplemental plant facilities, and in the flood control benefits.

The cost of supplemental facilities, as previously described, is based on the cost of the additional facilities needed to make the power outputs of the two schemes equal. In 1985, in line with Army assumptions used in the 1958 Columbia report, we have assumed all major hydro energy resources have been developed, and that the alternative source of energy is fuel-electric generation. Consequently, costs of supplemental energy are based on fuel-electric-generation unit costs supplied by Witness Lisk (FPC Exhibit 31). Any additional capacity requirements over that supplied by the fuel-electric source are, however, supplied by hydroelectric capacity sources at the unit cost derived in FPC Exhibit 26.

Q. Are those the main differences?

A. Yes.

Q. Will you refer to Sheet 2 of Table 2 of FPC Exhibit [fol. 1597] 25, and explain it?

A. This sheet is identical in form to Sheet 2 accompanying Table 1, and should not need further explanation. You will note that the supplemental usable energy requirement is supplied by fuel-electric generation, and that the supplemental capacity requirement is supplied by both hydroelectric and fuel-electric generation. The capacity supplied by fuel-electric generation is the minimum capacity that can be used to generate the indicated fuel-electric energy.

Q. Which items are transferred to Sheet 1 for evaluation as cost of supplemental facilities?

A. The usable energy and the dependable peaking capacity shown on lines 13 and 14 at columns 10 and 13, respectively.

Q. Please now turn to Sheet 1 of Table 3 of FPC Exhibit 25, and explain it.

A. This sheet contains the cost data for my Comparison "Q", which as for Comparison "P", represents conditions as of 1984-85. In Comparison "Q", as explained in connection with Table 3 of FPC Exhibit 24, I have assumed that Crevice could be constructed to provide upstream regulation of flows. With Crevice in service, Freedom and Whitebird in the common reach can be assumed in service, thus completing the development of the common reach.

[fol. 1598] You will note, therefore, that Sheet 1 of Table 3 contains costs for Whitebird. The costs for Freedom are omitted, because they are assumed the same in both schemes; and therefore in computing the differences in costs of the schemes, the Freedom cost components in each scheme cancel.

The computation of the supplemental requirements, which is shown on Sheet 2, was previously explained in connection with the similar Tables 1 and 2 of this exhibit.

While flood-control benefits would be shifted from Nez Perce to Crevice in Scheme B-1, and from Lower Canyon to Crevice in Scheme A-1, the transfer would be in equal amounts. I have not shown this adjustment on lines 27 to 30, since the differences on line 31, columns 6, 9, and 12, would not be affected.

Q. Mr. Meadowcroft, please turn to Sheet 2 of Table 3 of FPC Exhibit 25. Will you explain this tabulation?

A. The explanation of this table is the same as that given for Sheet 2 of Tables 1 and 2.

Q. Will you please refer to Table 4 of FPC Exhibit 25, and describe this table?

A. This table summarizes the results obtained from Comparisons "O", "P", and "Q", shown on Sheets 1 of Tables 1, 2 and 3, respectively, of FPC Exhibit 25. The [fol. 1599] figures in columns 4, 6 and 8, lines 4, 8 and 12, represent the excess annual costs of Scheme B-1 over Scheme A-1.

Q. Mr. Meadowcroft, will you refer to FPC Exhibit 26 consisting of Tables 1 and 2, and Table 3 in 2 sheets. Was this exhibit prepared under your supervision?

A. Yes, it was.

Q. Will you please give the general purpose of this exhibit?

A. FPC Exhibit 26 derives unit annual costs of Pacific Northwest hydroelectric energy and capacity which I need for determining the annual costs of specific quantities of hydroelectric power required for supplementary, or alternative sources, in my Comparisons "O", "P", "Q", and "W". The use of the unit costs in Comparisons "O", "P" and "Q" is shown on columns 1, lines 22 and 23 of Sheets 1 of Tables 1, 2 and 3, of FPC Exhibit 25. The use of the unit costs for Comparison "W", in estimating the Scheme B-1 alternative hydro cost during the initial 10-year period is used in lines 22 and 23, columns 1 of Sheet 1 of Table 2 of FPC Exhibit 27, the results of which are illustrated by Diagram C of Chart 1 of FPC Exhibit 27, which I will explain later.

Q. Will you show me in your tables the unit costs of Pacific Northwest hydroelectric energy and capacity that you derived?

[fol. 1600] A. These unit costs are shown on Table 3, Sheets 1 and 2, of FPC Exhibit 26, for interest rates at 2½%, 4½% and 6½%. Lines 9 and 10 of Sheet 1 show, respectively, the unit cost of usable energy and the unit cost of capacity that I used in connection with Comparison "O" in FPC Exhibit 25, and Comparison "W" in FPC Exhibit 27, at the line, table, and chart numbers given in my answer to the previous question. The unit costs of capacity which I used in Table 2 and 3, line 22 of Sheet 1, of FPC Exhibit 25, in connection with Comparisons "P" and "Q" are shown for three interest rates on line 5, columns 3, Sheet 2 of Table 3 of FPC Exhibit 26.

Q. Will you explain the derivation of the unit costs shown on lines 9 and 10 of Sheet 1 of Table 3 of FPC Exhibit 26?

A. Will you please refer to Table 1 of FPC Exhibit 26. The hydro projects I have selected as suitable as a basis [fol. 1601] of alternative costs are the first nine projects listed, those from Knowles to and including, Little Goods. These comprise projects authorized by Congress, and projects recommended by the Corps of Engineers and U. S. Bureau of Reclamation; and are all projects having relatively high benefit-cost ratios. The next 11 projects listed, Grand Coulee through Wanapum, provide only alternative costs of specific power facilities, which when combined with the similar facilities of the first 9 projects, provide the basis of determining the unit cost of alternative hydro peaking capacity.

The remaining projects, Kerr through Spokane river plants, are assumed to be existing as of 1967-68, and do not enter directly into the cost analysis, as no incremental costs are involved. The reason for including these remaining projects is in connection with the estimate of the usable energy produced by the incremental facilities, as I will explain later.

The projects and facilities for which data are listed in the column headed "Increment" provide, in my judgment, a reasonable estimate of the next cheapest hydro-alternative to that provided by the "common reach alternatives" that can be expected to be placed in service during the period 1968 to 1985.

The construction cost for the projects and facilities forming the increment were furnished by the Army, Bureau of [fol. 1602] Reclamation, and non-Federal agencies. The costs as furnished generally included step-up substations.

Section A of Table 2 shows the resources of a complete Pacific Northwest 1967-68 system, and a 1984-85 system, which include the Main System projects shown for each system on Table 1. The 1967-68 resources are based on adjusted Army Sequence V studies, and those for 1984-85 are based on adjusted Army Sequence IV-H studies.

Section B of Table 2 shows the Pacific Northwest load and reserve requirements for 1967-68 and 1984-85 corresponding to the resources of Section A. These requirements are based on those shown on FPC Exhibit 29, and include adjustments for requirements of the critical period months, as designated in the stipulated load shape data in Volume 1 of the transcript, and subsequent stipulations.

Section C of Table 2 shows the peaking capacity and usable energy resources provided by the hydroelectric facilities shown in the column headed "Increment" on Table 1 of FPC Exhibit 26. The resources as computed represent the increment over the period 1967-68 to 1984-85.

Section D of Table 2 shows "spot" values at year 1984-85 of the resources attributable to the incremental main system hydroelectric facilities as shown on Table 1. The [fol. 1603] peaking resources attributed to this increment are assumed numerically the same as those computed in Section C, namely, 4,814 mw. The usable energy resources assigned to capacity are the difference in prime energy and usable energy outputs of the 1984-85 systems, namely 1,466 average mw, or 12,842,000 mwh.

Sheet 1 of Table 3 of FPC Exhibit 26 shows the derivation of the unit costs of hydroelectric energy and peaking capacity for use in deriving annual cost of alternative hydro power during the period 1968 to 1978 and the year 1969-70. These unit costs are the cost of an energy component of hydroelectric facilities, shown on line 9, and the unit cost of a capacity component shown on line 10. The computation of these unit costs, at each of three interest rates, is as follows:

The annual costs of the increment from Table 1 which consist of joint facilities and specific power facilities, and their total, are shown in columns 1 on lines 5, 6, and 7 of Table 3. These annual costs are assigned to an energy component and a capacity component as shown by columns 2 and 3 under each interest rate. The total annual costs assigned to energy and capacity are shown on line 7, in columns 2 and 3 under each interest rate. I will explain later the basis of the assignment of annual project costs to energy and to capacity.

[fol. 1604] The usable energy produced by the increment of Table 1, and the peaking capacity, are shown in Table 3, Sheet 1 on lines 2 and 3 at columns 1 under each interest rate. They are the same irrespective of the interest rate. These power output figures are also assigned to an energy components, and to a capacity component, as shown by columns 2 and 3 under each interest rate. The usable energy assigned to capacity on line 2, columns 3, equal to 4,757,000 mwh, is the usable energy in excess of prime energy that is produced by the incremental capacity of the Table 1 increment; that is, the capacity in excess of the capacity required for production of the prime output associated with the increment. This capacity component of energy, 4,757,000 mwh, is evaluated by a "cut and try" process, at three different interest rates, at the 0.93, or 1.30, or 1.71 mills/kwh unit costs shown on line 9, and the amounts so determined on line 6, columns 2, equal to 4,424, or 6,184, or 8.134 thousand dollars, is deducted from

the cost of the specific power facilities to obtain the cost of the capacity component shown by columns 3, lines 6 and 7.

The unit annual cost of the energy component of the alternative hydroelectric facilities of the Table 1 increment is obtained by dividing the energy component costs on line 7, columns 2, equal to 30,540, or 42,731, or 56,475, by the total [fol. 1605] usable energy of the Table 1 increment shown in columns 1 at line 2, and equal to 32,990,000 mwh. These unit costs are 0.93, 1.30, and 1.71 mills per kwh for interest rates of 2½ per cent, 4½ per cent, and 6½ per cent, respectively.

The unit annual cost of the capacity component of the alternative hydroelectric facilities of the Table 1 increment is similarly obtained by dividing the capacity component costs on line 7, columns 3, equal to 32,726, or 42,321, or 53,209 thousands of dollars, by the peaking capability of the Table 1 increment, 4,814 mw, as shown on line 3, columns 3. These unit costs are $6.80, $8.79, and $11.05 per kw for interest rates of 2½%, 4½%, and 6½%, respectively.

Lines 13, 14, and 15 show the use of the unit costs in re-estimating the total cost of the Table 1 increment. You will note that the re-estimated annual cost is the same as that given on line 7.

Q. You stated previously that you would further explain the distribution of the annual costs of the Table 1 increment to the capacity and energy components?

A. Basically, the capacity component is assumed related to the cost of the specific power facilities which are shown on line 6 of Sheet 1 of Table 3 of FPC Exhibit 26. I also explained the adjustment to this cost of reducing the cost of the specific power facilities by the dollar value of [fol. 1606] "secondary" usable energy produced by incremental capacity facilities. This adjustment is shown on line 6, columns 2, and the net capacity cost is shown on the same line at columns 3.

Similarly, the energy component is basically the cost of dam and reservoir facilities which are shown on line 5, columns 2. This figure divided by the usable energy produced, shown on line 2, columns 1, would give an approximately cost of usable energy. However, since not all specific power facilities have been assigned to capacity, the unassigned portion must be assigned to the energy component, as shown in columns 2, line 6, of Sheet 1. This is logical since specific power facilities equal, at least, to the nominal prime capacity, are required to produce energy.

We also made the assumption, for the initial 1968-78 period, and for the year 1969-70, that the unit value of the energy assigned to capacity would be the same as the value of energy finally determined for the energy component. This assumption results in a "cut and try" process in determining the unit usable energy cost.

Q. Mr. Meadowcroft, I refer you to Sheet 2 of Table 3 of PFC Exhibit 26, which is a continuation of Sheet 1 you have just explained. Will you describe this sheet?

A. Sheet 2 of Table 3 of FPC Exhibit 26 gives net costs [fol. 1607] of hydroelectric capacity only, for interest rates of 2½%, 4½% and 6½%, under year 1984-85 conditions for use in estimating supplemental power requirements as required by my Comparative Studies "P" and "Q". I refer you again to line 22 of Sheet 1 of Table 2, and line 22 of Sheet 1 of Tables 2 and 3 of FPC Exhibit 25, where these data are used.

The annual costs of the specific power facilities shown on line 4, columns 1, of Sheet 2 of Table 3, for the three interest rates, are the same as those shown on Sheet 1 of Table 3 of FPC Exhibit 26, at lines 6, in columns 1.

As in the case of the estimate of net cost of specific power facilities for the initial 10-year period shown on Sheet 1 of Table 3, a credit is given to capacity equal in amount to the dollar value of the usable energy assigned to capacity. This credit is again based on the usable energy output assigned to capacity, as is shown on line 1, columns 2, of Sheet 2 of Table 3. However, the dollar credit

to capacity, which is shown on line 4, columns 2, in this case is based on the fuel-electric energy replacement values given on FPC Exhibit 31, and is shown on line 3 of Sheet 2 of Table 3. The gross unit costs of peaking capacity, the unit value of the energy credit to capacity, and the net unit cost of the capacity component for 1984-85 conditions are [fol. 1608] shown on line 5 at columns 1, 2, and 3, respectively, for each of three interest rates.

The resulting net capacity costs used in the Comparison "P" and "Q" studies are $0.12, $2.34, and $4.82 per kw of peaking capability for each of the three interest rates, 2½%, 4½%, and 6½%. These values are shown at columns 3 on line 5 of Sheet 2 of Table 3 of FPC Exhibit 26.

Q. Mr. Meadowcroft, please refer to FPC Exhibit 27 consisting of Charts 1, 2, and 3; and Tables 1, 2, and 3. Was this exhibit prepared under your supervision?

A. Yes, it was.

Q. Will you please explain this exhibit?

A. FPC Exhibit 27 presents the cost phases of Comparative Study "W", which is an additional study of Schedules B-1 and A-1, in which High Mountain Sheep of Scheme A-1 would be assumed in service in 1967-68, and Lower Canyon of Scheme A-1 and Nez Perce of Scheme B-1 would be assumed in service in 1977-78; i.e., 10 years later.

Q. Will you refer to Chart 1 of FPC Exhibit 27, and explain it?

A. Chart 1 outlines the five steps, using five diagrams A, B, C, D, and E of the analysis of Comparison "W". It uses cost data of the common reach projects based on [fol. 1609] Comparative Studies "O" and "P", which are shown by Tables 1 and 2 of FPC Exhibit 25. Alternative costs to High Mountain Sheep during the initial 10 years are shown on two bases, one based on alternative hydro, and the other based on alternative fuel-electric costs.

For illustrative purposes, 4½% interest rate is assumed for Chart 1.

Diagram A of Chart 1 shows the outputs of dependable peaking capacity and usable energy of Schemes A-1 and

B-1 by subperiods between July 1, 1967 and June 30, 2027. These are the 10-year "delay" period, July 1, 1967 to June 30, 1977, during which High Mountain Sheep is assumed in service, and the 50-year amortization period for Nez Perce or Lower Canyon extending from July 1, 1977 to June 30, 2027.

The usable energy and dependable peaking capacity outputs to be supplied during the first 10 years are those of the High Mountain Sheep project of Scheme A-1. These are taken from Table 4 of FPC Exhibit 24. Alternatively, these outputs during the initial period in Scheme B-1 will be supplied by alternative hydro from outside the common reach, and, second, by alternative fuel-electric power; that is, two cases will be studied. During the 50 years following the initial period, the outputs for both schemes are determined from Comparative Studies "O" and "P". The facili- [fol. 1610] ties include the common reach alternative plants and supplementary facilities of these two studies, as shown by Tables 1 and 2 of each of FPC Exhibits 24 and 25. Hells Canyon is excluded since it is the same for both schemes. Outputs from July 1, 1977 to June 30, 1984 are interpolated from Studies "O" and "P", as shown by dotted lines on Diagram A. Outputs following July 1, 1984 to June 30, 2027 are assumed the same as for 1984-85.

Diagram B shows the net annual cost year-by-year from July 1, 1967 to June 30, 2017 of producing the power by Scheme A-1 facilities, i.e., by High Mountain Sheep during the first 10 years, and by High Mountain Sheep, Lower Canyon, and China Gardens during the next 50 years. Credit is given for flood control benefits, and for the reduction in annual costs of High Mountain Sheep during the 10 years following the completion of its amortization period on June 30, 2017.

Costs of Scheme A-1 including High Mountain Sheep, 5 units, during the 10-year initial period are from line 31 of Table 2 of FPC Exhibit 27. Costs of Scheme A-1 for the next 7 years, July 1, 1977 to June 30, 1984, are derived from Comparisons "O" and "P", as shown by FPC Exhibit 25, Tables 1 and 2. Costs for this 7-year period are

interpolated; then expressed as an equivalent average an-
[fol. 1611] nual cost. Those from July 1, 1984 to June 30, 2017 are assumed the same as those for 1984-85; and those for the final 10 years are as shown by Table 3 of FPC Exhibit 27. The drop in cost during the last 10-year period represents the reduction in High Mountain Sheep costs following completion of its 50-year amortization period.

Diagram C shows the net annual cost over the 60 years, July 1, 1967 to June 30, 2027, of producing the power indicated by Diagram 1 using Scheme B-1 facilities, including the common reach plants, and alternative and supplemental power.

The power during the initial 10-year period is generated, alternatively, by Pacific Northwest alternative hydro from outside the common reach, or by fuel-electric sources. The annual cost of the hydroelectric alternative is obtained by evaluating the capacity and energy shown in Diagram A for this period at the unit values derived for the initial 10-year period given on lines 9 and 10 of Sheet 1 of Table 3 of FPC Exhibit 26. This cost is shown on Sheet 1 of Table 2 of FPC Exhibit 27. The alternative annual cost using fuel-electric source is shown by Sheet 2 of Table 2.

The annual cost from July 1, 1977 to June 30, 1984 is interpolated, then expressed as an equivalent uniform cost, using the cost data for Scheme B-1 from Comparisons "O" and "P", which is given on FPC Exhibit 25, Sheets 1 of [fol. 1612] Tables 1 and 2, respectively. Annual costs from July 1, 1984 to the end of the period on June 30, 2027 are assumed to be the same as those for 1984-85 of Comparison "P".

Diagram D shows year-by-year over the 60 years the cost of Scheme B-1 in excess of Scheme A-1. It is obtained by the subtracting for each year the ordinate of Diagram B from the ordinate of Diagram C, and plotting the difference.

Diagram D may also be interpreted as follows: The area numbered (1) represents the annual costs of Scheme B-1 in excess of Scheme A-1 substantially as shown by Com-

parison "P" on Table 2 of Table 4 of FPC Exhibit 25. The difference is that in this case the in-service date of the major alternatives is 10 years later, at July 1, 1977, than for Comparison "P". The area numbered (2) between July 1, 1967 and June 30, 1977 expressed the dollar savings during this period of using the High Mountain Sheep project of Scheme A-1, instead of the Pacific Northwest alternative hydro required by Scheme B-1. The area numbered (3) between 2017 and 2027 also represents an additional saving by use of High Mountain Sheep during the initial period 1967 through 1977. This savings represents the reduction in annual cost of High Mountain Sheep project following the completion of the project's 50-year amortization period. The area numbered (4) represents additional Scheme A-1 savings if fuel-electric power is used [fol. 1613] as an alternative to High Mountain Sheep during the initial 10-year period, instead of alternative hydro.

Diagram E shows the same information as is shown by Diagram D, except the areas numbered (1), (2), (3) and (4) of Diagram D are shown as uniform annuities over the period of amortization of the Nez Perce or Lower Canyon projects. The uniform annuity represented by area (1) plus area (2) plus area (3) is the total excess cost of Scheme B-1 over Scheme A-1 for the 60 years July 1, 1967 to June 30, 2027, in which both schemes are scheduled to produce the equal power outputs shown by Diagram A, and use the hydroelectric facilities, whose costs are shown by Diagrams B and C.

If, during the initial 10-year period, alternative fuel-electric facilities are used in Scheme B-1 instead of alternative hydroelectric facilities, then the uniform annuity expressed by area (1) plus area (2) plus area (3) plus area (4), is the excess cost of Scheme B-1 in excess of A-1.

All information given by Diagrams B, C, D, and E of Chart 1 of FPC Exhibit 27 are based on 4½% interest.

Q. Please refer to Chart 2 of FPC Exhibit 27, and explain it?

A. This chart gives data which are similar to and derived in the same manner as those given by Diagrams D [fol. 1614] and E of Chart 1, except that the costs are based on 2½% interest rate.

Q. Please refer to Chart 3 of FPC Exhibit 27, and explain it?

A. This chart gives data which are similar to and derived in the same manner as those given by Diagrams D and E of Chart 1, except that the costs are based on 6½% interest rate.

Q. If Diagram A of Chart 1 of FPC Exhibit 27 were included in Charts 2 and 3, would it be identical to that shown on Chart 1?

A. It would be.

Q. Will you refer to Table 1 of FPC Exhibit 27, and explain it?

A. Table 1 summarizes the excess cost of Scheme B-1 over Scheme A-1 under the conditions described in detail by the diagrams of Chart 1, and in part by Charts 2 and 3. The excess annual costs of Scheme B-1 over A-1 are given in this table for 2½%, 4½%, and 6½% interest rates.

The table also shows that there will be an additional excess cost of Scheme B-1 over A-1 if alternative fuel-electric facilities are used, instead of alternative hydroelectric facilities with Scheme B-1 during the initial 10-year period July 1, 1967 to June 30, 1977.

[fol. 1615] Chart 1 illustrates the detailed step-by-step computation of the data contained in Table 1 for the 4½% interest rate computation.

Q. Will you please refer to Sheet 1 of Table 2 of FPC Exhibit 27, and explain it?

A. Sheet 1 of Table 2 shows for each of three interest rates, 2½ per cent, 4½ per cent, and 6½ per cent, the annual costs of Scheme A-1 and Scheme B-1 at year 1972, as estimated in Comparison Study "W". Scheme B-1 costs in this case are based on alternative hydroelectric power. The A-1 and B-1 annual costs, under 4½ percent interest rate, as shown plotted at year 1972 on Diagrams B and C, respectively, of Chart 1 of FPC Exhibit 27.

Q. Please refer to Sheet 2 of Table 2 of FPC Exhibit 27, and explain it?

A. Sheet 2 of Table 2 is similar to Sheet 1 of Table 2 with one exception. The costs of the energy requirements of Scheme B-1 at year 1972 are based on alternative fuel-electric power instead of alternative hydro-electric power.

Q. Will you please refer to Table 3 of FPC Exhibit 27, and explain it?

A. Table 3 shows for each of three interest rates, 2½%, 4½%, and 6½%, the annual costs of Scheme A-1 and B-1 for the 10-year period, July 1, 2017 to June 30, 2027, as re- [fol. 1616] quired by Comparison "W". The A-1 and B-1 annual costs, under 4½% interest rate, are shown plotted at years 2017 to 2027 on Diagrams B and C, respectively, of Chart 1 of FPC Exhibit 27.

Q. Mr. Meadowcroft. Do you have any further comments on your Comparison "W"?

A. I have one further comment. Study "W" as I presented it assumed Lower Canyon of Scheme A-1 and Nez Perce of Scheme B-1 in service in 1977-78, and High Mountain Sheep in service in 1967-68. Except for the delayed in-service dates of Lower Canyon and Nez Perce, the common reach plants are substantially as shown by Comparison "P", in Table 2 of FPC Exhibit 25.

I could have made a study similar to "W" using comparison "Q" instead of Comparison "P" as a base. If I had, Whitebird would have been included in the B-1 scheme, and both schemes would have been regulated by Crevice.

Since Comparison "Q" resulted in higher differential costs for B-1 than did Comparison "P", I would expect that revision of Comparison "W" to include Whitebird in the B-1 scheme would increase the excess annual costs of Scheme B-1 over Scheme A-1.

Q. Mr. Meadowcroft. In the agreement between applicants contained in Volume 1 of the transcript, it was [fol. 1617] stipulated that the normal pool elevations of the proposed Nez Perce project of Applicant Project 2273, and

of the proposed High Mountain Sheep project of Applicant Project 2243, should each be at elevation 1,510. You are aware that the Army, the Commission staff, and the Applicants Projects 2243 and 2273, have used, in this or former proceedings, elevation 1,490 as normal pool elevation for Nez Perce or High Mountain Sheep. I see that in your studies you used normal pool elevation 1,510 for both Nez Perce and High Mountain Sheep. Did you consider the relative economics of these projects at both elevations?

A. Yes, I did. The Army in its 1958 Report on the Columbia Basin provided cost and benefit data on the projects at elevation 1,490. Also, in connection with a report on the Hells Canyon development of Project 1971, the Army presented data on Nez Perce and High Mountain Sheep projects with normal pool elevations at 1,490 and 1,510.

I have reviewed and checked the benefits of High Mountain Sheep and Nez Perce projects at both elevations 1,490 and 1,510, and by relating them to corresponding costs reviewed by Witness Froggatt, I have concluded that for the purpose of comparative studies, the economy of either project at normal pool elevation 1,510 is equal to, or better than, that at elevation 1,490.

Q. More specifically, what is the basis of your conclusion that the economy of the High Mountain Sheep project with [fol. 1618] normal pool at elevation 1,510 is equal to, or better than, that with normal pool elevation 1,490?

A. As I said, I reviewed the available studies that I indicated and made a reconnaissance-type check study. The results of my check study are as follows: The annual cost of the High Mountain Sheep project with normal pool elevation 1,510, based on Mr. Froggatt's review, and assuming 2½ percent interest rate, was about $11,800,000. With credit for flood control benefits, the net annual cost would be about $9,500,000. The corresponding unadjusted annual cost of the project with normal pool elevation 1,490 is about $11,450,000. With this amount increased $450,000 annually

for supplemental fuel-electric power to make the power output of this project equal to that of the elevation 1,510 project, and a credit given for flood control benefits, I found the adjusted cost of the project to be $9,600,000 annually; that is, about $100,000 annually in excess of the project with pool elevation 1,510 feet. The economy of the High Mountain Sheep project with pool elevation 1,510 therefore, appears equal to and possibly somewhat superior to that with pool elevation 1,490.

Q. What is the basis of the conclusion that the Nez Perce project with normal pool elevation 1,510 is more economic than that with normal pool elevation 1,490?

[fol. 1619] A. I reviewed the available studies that I indicated and made a reconnaissance-type check study. My results are as follows: The annual cost of the Nez Perce project with normal pool elevation 1,510, based on Mr. Froggatt's review and assuming 2½ percent interest rate was about $15,100,000. With a credit for flood control benefits, the net annual cost would be about $8,600,000. The corresponding unadjusted annual cost of the elevation 1,490 project is about $14,500,000. With annual cost credited for flood control, and with upward adjustment for supplemental power facilities to provide the same power output as the elevation 1,510 project produces, the annual cost of the elevation 1,490 project is about $9,100,000 or about $500,000 annually in excess of that of the elevation 1,510 project. The Nez Perce project with normal pool elevation 1,510 thus appears economically superior to that with normal pool elevation 1,490.

Q. Do your reconnaissance-type studies confirm the studies of the Army Engineers?

A. Yes, they do.

* * * * * * *

[fol. 1634] K. M. Robinson was called as a witness, being first duly sworn, and testified as follows:

* * * * * * *

[fol. 1645] Cross examination.

By Mr. Cluck:

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[fol. 1715] Reference is made in your testimony to the Northwest Power Pool. I wanted to clear that up, in just a few words.

That is essentially a kind of clearing house for the participants so they can level off their peaks?

[fol. 1716] A. It goes up further than that. It is integrated operation of the plants in the Pacific Northwest.

Q. You have been participating in that, have you?

A. Yes, Washington Water Power has been a participant, yes.

Q. What one for purpose of—one for purpose of your participation is that when you have a dam like High Mountain Sheep and you have peaking power at a given season, you can put that in the bank, and draw from others when you need it?

A. If somebody else can use it. Peaking capacity can't be stored away.

Q. That is right.

And what other function, so we have the record complete, does the Northwest Power Pool perform?

A. They— Each of the members has a man on the committee that operates the Northwest Power Pool. It even goes to the extent of determining whose reservoir is to be drawn when, and how much.

Also, prior to the operating season a determination is made as to when each organization takes units out for maintenance, and insofar as possible, that operating program is carried out by the participants, largely because there is something in excess of one million kilowatts, I am told, of additional firm load-carrying capability as a result [fol. 1717] of this coordinated operation.

Q. So the effort is directed that each one of the participants can get the full, as nearly as possible, utilization from the particular plants they have?

A. At least get enough power to carry his load with.

* * * * * * *

[fol. 1759] By Mr. Sander:

Q. I notice in connection with your testimony on the Northwest Power Pool, you speak of coordinated operations on an equitable basis. Could you elaborate on that statement?

A. Well, coordination on an equitable basis means that if one company's facility, power plant, for instance, is required for the benefit of the whole to do some operation that is detrimental—

[fol. 1760] Q. Would you explain the type of operation you have in mind as detrimental?

A. Say Washington Water Power owns a plant with a fairly substantial amount of storage, and it was to the best interest of the pool as a whole to hold that storage in reserve, and then for a later operation, when there is a hole in the reservoir downstream, an equitable coordination means in some way you would be compensated in kilowatt-hours or something for any loss of value that was created to that plant as a result of holding that plant in readiness to take care of the problems of the pool as a whole.

Q. Do you contemplate that equitable arrangement is to be accomplished by agreements between the parties?

A. It should be. In the past the power pool has operated as a voluntary pool. It has operated particularly during the war at a very high degree of efficiency. That efficiency has slipped off to an extent as certain members of the pool became self-sufficient themselves, and there wasn't quite the urge on their part to do a full job of cooperation and coordination under those circumstances. It will be very much better when the whole pool operates on, I would say, a contractual basis or on some agreement basis that takes

into consideration the benefits that the various members of [fol. 1761] the pool create for other members of the pool.

Q. Does that then mean all the members of the pool would have to enter into some kind of contract with each other?

A. I think eventually it is coming to that. How long it would take, I couldn't say.

Q. As to the matter of flood control, you mention that will be operated in accordance with the requirements of the Corps of Engineers.

To what steps for flood control do you have reference in your answer?

A. It is the flood control that is required on the Columbia and its tributaries to keep the maximum flow at the Dalles plant to approximately 600,000 cubic feet per second.

Q. How will, say for instance, High Mountain Sheep—what provisions have you made in the structure of the plant itself to meet those requirements?

A. The cost includes the valves, low-level valves, for discharge of the water for flood control purposes to bring the water down to take care of an anticipated flood.

Q. You anticipate to operate those in accordance with what the Corps of Engineers may request you to do?

A. Yes.

* * * * * * *

[fol. 1771] Cross examination. (Resumed)

By Mr. Cellars:

Q. You have testified in your direct testimony, on page 160 and page 161, to the effect that Pacific Northwest Power has felt that they should not propose any fish passage facilities for Mountain Sheep because they believe such a proposal should come from the government agencies, government and state agencies. Is that correct? You have not proposed such facilities?

A. No, we have not proposed in our testimony fish facilities. However, we have included in our estimates the estimated cost of fish facilities, and of course any fish

facilities would have to be worked out with the proper governmental agencies.

Q. However, you do mean that "We have, on the other hand, done a great deal of work on the facilities and we have formally submitted to the responsible agencies designs of facilities that Dr. Hamilton will subsequently testify have been developed in view of the unique situation at High Mountain Sheep to utilize as far as possible proven experience at other projects."

It is my understanding, in view of that statement, that PNPC has not submitted any fish passage facilities. Is that correct?

A. You mean in this hearing?

[fol. 1772] Q. Yes.

A. I am not sure just what Mr. Hamilton will testify to in this hearing.

Q. I notice you say "These facilities will be quite costly, more costly than any cost estimates for any of these projects by government agencies would have indicated."

Does that mean, Mr. Robinson, that that cost estimate puts a limitation on what PNPC would be willing to spend for fish passage facilities?

A. No. We would have to spend whatever the costs are of the fish facilities that are either set up in any license that is issued to us and worked out in agreement with the federal and state fish agencies.

* * * * * * *

[fol. 1867] Q. In connection with the matter of the Northwest Power Pool, which we inquired about yesterday, I have just a few questions.

[fol. 1868] Presiding Examiner: Are you now finished with the recreation?

Mr. Cluck: Yes.

By Mr. Cluck:

Q. You stated, as I understood the question, that in the coordination, as you termed it, that one distributing unit would buy power which had its source from some other—any one of the other suppliers in the pool; is that right?

A. Well, it might buy, or exchange, or store, surplus power in other people's reservoirs, many operations other than just sale of power.

Q. Is it accurate to say that the operation of utilities in the Northwest, especially in connection with the Bonneville grid, is on a coordinated basis to greater or less degree, throughout the region?

A. Yes, it is on a fairly coordinated basis in the whole Northwest Power Pool Area, something less than the degree of efficiency that we had during the war.

Q. And somewhere in your testimony the statement is made, in substance, that in planning your relationships with the pool, each one assumes that the others will be governed by self-interest in determining whether he takes his power or doesn't, at any given time?

A. Well, I think he is taking power based on require- [fol. 1869] ments, rather than on his thinking.

Q. In other words, it is the price at which the energy is made available that governs; is that it, essentially?

A. Not necessarily. In the pool they have operated sometimes purely for an insurance policy.

Q. But it is all planned and set up on the basis that each member will or will not take power, depending on self-interest, depending on need, and the price of the power and its availability at the time?

A. That is not a fact. Because Washington Water Power, for instance, holds water in one of its reservoirs a good many times as an insurance policy for the pool, and you can't tell when we are going to have a big rain, and many times that water, a lot of it, washes out to the sea, and we have paid for power in the meantime.

Now, if our thinking went to the minimum cost of power, we would say "Let the other guy worry", and we would

dump that water down the stream instead of holding it back for an insurance policy for the over-all pool.

Q. The testimony I have specific reference to is found on page 147. Would you turn to that, please? Line 22 is a part of it.

"Since proper coordinated operation on an equitable basis in the long run benefits all parties concerned, I am confident that all parties will be willing to develop agree-
[fol. 1870] ments which will provide for coordinated operation under fair and equitable terms."

Does that fairly reflect—

A. I think they will. I may be optimistic. But I think that when they finally get down to a basis of where they stop fighting over the hydro, that there will be some sensible coordination that will actually be on a benefit basis to everybody concerned.

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[fol. 1908] By Mr. Sander:

Q. Just a few general questions, to begin with, Mr. Robinson. In your testimony—this is more or less by way of clarification: On your replies to my questions with regard to the operation of the power pool, you have indicated that as some of these utilities in the pool have become more self-sufficient, it has been harder to accomplish coordination.

Just what has happened that brings you to the conclusion that it has been harder to obtain coordination? Specifically, what has happened?

A. Well, 100 per cent coordination is based on self-interest, and if somebody becomes self-sufficient there is not quite the self-interest that there is if they may be short of power themselves. And it is a little more difficult then. It has operated fairly well, we are not complaining about it at the present time. We do see, as we go down the road
[fol. 1909] and more of the distributors become self-

sufficient with their own generation or long-time power purchases, it is a little more difficult.

There have been some contractual setups already developed. There is one between Pacific Power and Light, Idaho Power, and ourselves, by contract, and I think as we go along with this there will be more contractual pooling than there has been in the past.

Q. In other words, you foresee difficulties in the operation of the pool in the future?

A. Well, I don't see difficulties, because I think that the self-interest is going to be great enough that the voluntary pool we have had in the past will actually develop into a contractual operation of a pool.

Q. Could you give me any specific example of what you mean by the "difficulty"? Has an instance occurred where one utility did not wish to release the water, or wanted to release water at a time when the others didn't?

A. Our major trouble is with Bonneville, who hold their water in Hungry Horse, to force us to buy power from Bonneville at 2½ mills.

Q. I wanted to get a specific idea of what you were foreseeing. And it is your feeling by some method of contract that an arrangement can be made by which this can be rectified?

[fol. 1910] A. Yes.

Q. And I presume if you are to receive a license for High Mountain Sheep, if contracts are necessary, you would be willing to take part?

A. Certainly, more than willing.

* * * * * * *

[fol. 1915] By Mr. Sander:

Q. Mr. Robinson, in your prepared testimony, at page 70, you pledged to work with the federal and state agencies with regard to recreation. Can you tell me just generally what contacts have been made with the state agencies on that matter?

A. There have been contacts made with the Forest Service, who own most of the land on which recreational facilities would be put. This has been discussed also with the Parks Department of the State of Oregon. And I believe some mention has been made of this to the people in Idaho, with whom we will have to have to work in final plans for recreational facilities.

Q. And you said you forsee no difficulties?

A. No. We have had none on the dams we have built. I don't anticipate any in connection with this dam.

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[fol. 1945] Q. We were talking of flood control, and got [fol. 1946] on the subject of Army requirements, and you had mentioned that you would operate High Mountain Sheep in accordance with their requirements and hoped to have compensation where it would result in the loss of power. Will you also operate the dam and reservoir in accordance with those requirements, even though they do not get compensation for loss of power?

A. Yes. We will have to do that.

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[fol. 2765] Testimony of CHARLES C. BONIN

Cross examination.

By Mr. Wise:

Q. What project was under consideration in 1955 that opened these negotiations?

A. Low Mountain Sheep and Pleasant Valley and an alternate to that of High Mountain Sheep above the mouth of the Imnaha.

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[fol. 2771] Q. What chronologically were the events which took place which resulted in the change from your 1955 quotation to the one which you have just described to us?

A. Our original order specified certain lengths of time at which the order was to be reopened or renegotiated with

respect to price increases, escalation terms, and certain other items in it.

One of those dates came about at about the same time [fol. 2772] that the company concluded that they were not going to build Low Mountain Sheep and Pleasant Valley, and were considering alternate higher developments in the Middle Snake River. At that time we sat down with General Electric—

Q. Pardon me. About what time?

A. This was about March of 1957, somewhere in that area—and we renegotiated—yes, March 1, 1957—we renegotiated that original contract to its present form, which is the 1,055,000 kva at 25 percent off book, and all additional kva at 15 percent off book.

That was book at that time, and that order at that time was subject to further negotiation at certain specified times.

Q. When are those certain specified times?

A. The last one of those was this past March, when the book price as of March of this year was inserted in the contract. The discount now applies to the book price as of this past March.

. . . . . .

[fol. 2834] Q. Did you make designs for Nez Perce before you applied for the Low Mountain Sheep-Pleasant Valley project?

A. I believe—

Mr. Hugh Smith: I will object to that as irrelevant.

Presiding Examiner: I agree it is irrelevant, but I will permit him to answer the question.

The Witness: I believe that one layout had been made of that project at the time we reviewed a number of Northwest projects.

. . . . . .

[fol. 3251] Testimony of A. E. ALSPAUGH.

Cross examination.

By Mr. Riley:

Q. I will skip over a couple of points here and ask you: You have stated earlier that you have reached different heads on each of the three projects. I would like to have an explanation of the reason for comparing storage volumes corresponding to drawdown. At Lower Canyon we [fol. 3252] have 59-2/10 percent. I understand that is six percent and 71-3/10 percent for Nez Perce—your Nez Perce, not the Power System's Nez Perce—and High Mountain Sheep.

I would like to know what are the reasons for comparing storage volumes to drawdown with different percentages of design head?

A. Every reservoir had its proper drawdown. I might answer your question a little like this. Take the project such as the Hungry Horse project in Montana, where the outflow during the wintertime is about 10 percent of your regulated flow, your drawdown is close to 50 percent. On the other hand, if you take a project like Grand Coulee where the outflow during the storage drawdown period or during our power operation period that is most critical, your drawdown is only about 22 percent.

In other words, it is the relationship of the runoff of the stream between the winter and summer. On this particular river we find that the Snake River through the region of the Mountain Sheep project is what we call a well-regulated stream. The ratio of the average runoff to more or less the normal high water in the spring is about four to one.

On the other hand, the Salmon River has a ratio of about 3,000 cfs in the wintertime to about 60,000 in the summer, [fol. 3253] May and June, and the ratio is very close to about 20 to one—in other words, about five to one.

Therefore, with the different runoff relationships you get a different drawdown relationship at your respective reservoirs.

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[fol. 3272] Q. Mr. Alspaugh, at page 312 of your direct testimony you state a dam on the Snake and the Salmon above the confluence of the two streams will be more effective to control the streams than one dam below the confluence. Is that a fair statement of your testimony there?

Mr. Smith: What page?

Mr. Riley: 312, Mr. Smith.

A. Yes, they give you somewhat slightly greater flexibility.

By Mr. Riley:

Q. Is that observation made with regard to power operations only?

A. Not entirely. There are some conditions and other multi-purposes uses—flood control in particular—in certain relationships that might be true.

Q. May I ask you, if the problem you had under consideration was storage or water storage for flood control, would not one dam more efficiently control the flow of both streams?

[fol. 3273] A. It might during certain floods, but other floods it might not.

Q. Could you give me an example of what you mean when it would not?

A. When it would not?

Q. Yes.

A. It might be when the Salmon was with an extremely voluminous runoff.

Q. If you had the Salmon with an extremely high volume of runoff, would not a single dam be more efficient?

A. That is what I thought you asked. It might be in that particular case. On the other hand, there are other cases

where you might have the reverse. You might have a greater high volume runoff on the Snake.

Presiding Examiner: Would you speak up a bit, Mr. Alspaugh.

By Mr. Riley:

Q. Would you state whether or not the flow characteristics of the Salmon and the Snake are different?

A. They are quite different.

Q. They flood at different times generally?

A. Well, let me say it this way. I think Mr. Bonin fairly well answered that particular question in one of his answers last week. The general flooding of the Salmon River will almost invariably be during the months of May and [fol. 3274] June, almost as a clock. In other words, you can almost depend on the Salmon River never to have flows between October and March that will vary more than three to eight thousand cfs on the average. The Salmon in May or June will rise to its maximum, cresting in general three weeks to four weeks later than perhaps the Snake River in the same area.

The Snake River, on the other hand, has its normal flood at that particular time of the year. But, on the other hand, the Snake can flood at any time from December on.

Q. Would you state that the flooding of the Snake is now largely controlled with existing storage facilities?

A. Well, again I think that we have to relate it between volume and peak. Peak flood, the Snake does not have too great of what we call a peak, as such. But the Snake does have a rather large volume. In other words, that is what will vary. Of course in the flood control plan the volume is more important than the peak itself with respect to the area below Portland, or in the Portland area.

Q. On the other hand, there is no storage at all presently on the Salmon?

A. That is correct.

Q. Which, if I understand your testimony, then, makes one dam for storage for flood control more—it gives a single dam, if I understand your testimony, an advantage [fol. 3275] over two dams.

A. I don't think I said that. I said there are occasions that it would, on the one hand. Perhaps on the other hand there are occasions it might not—depending on the runoff of the respective streams.

* * * * * * *

[fol. 3280] Q. Why wouldn't the mid point of this 50-year period—the 50-year period you have used for your power routing studies—be a good place to begin postulating the developments to be included within the common reach in considering the economic benefits which you show?

Mr. Hugh Smith: Just a moment, Mr. Alspaugh. It seems to me Mr. Riley is now discussing theory and practice of studies rather than examining this witness as to the studies he has made. I object to the question as being outside the proper scope of cross.

Presiding Examiner: I will permit Mr. Riley to examine the witness as to the basis for selecting the criteria on the study he did make. I assume this is addressed to that area.

A. In reply to that, I would say that I personally in any study that I have ever conducted, I like as many points [fol. 3281] along the 50-year period that I can put my finger on. Certainly, generally speaking, a very minimum of two is considered desirable. I have used what I call a three-point analysis. In this particular study we were able to use what we call a four point analysis, points being at different periods in time during this 50-year period. In other words, the initial point, the second point, and the third point and finally what you estimate near the end of the 50-year period.

Now I think we would all recognize that we can somewhat see what we expect for the next five or ten years a whole lot more than we can from the turn of the century on. For that reason I give a much greater weight to the

early years than I would during the latter years. That, I think, is reflected in what I call a four point analysis.

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[fol. 3287] Q. Now, referring to page 284 of the transcript, line 23 at the end of the page through line 1 on page 285, where you refer to the data which you supplied Mr. Bonin on power plant characteristics, initial installation, required capacity, rated head turbine for minimum power pool.

Would you tell me what peaking capability you assumed for High Mountain Sheep? Maybe the word "establish" would be more accurate.

A. I am just wondering which came first is all—the power routing studies or the peaking that I assumed there. Actually, the peaking that I obtained was the result of the power studies. Maybe I don't understand.

* * * * * * *

[fol. 3289] Q. Would you tell me how you establish the critical head at High Mountain Sheep?

A. The critical head or design head of any storage reservoir involves a great number of factors. Probably one of the more important factors involves this question of timing, the system the project is operating in.

In other words, that is another reason why we think it is important to examine the 50-year period to get some reasonable idea as to what the reservoir will function at in the different power routing studies.

Obviously we give greater weight in our consideration to the initial systems that we can foresee in the next ten or fifteen years. In doing that, and since we have done it many, many times on this river, as well as other rivers, we get a pretty good idea as to how these projects will function in the Pacific Northwest.

I have found that the reservoir level in the initial system, [fol. 3290] for example, without the China Gardens project, will be in the neighborhood of elevation 1468, for example. I believe in the early years it will be about 1472 if we in-

stall China Gardens and Lower Canyon. And it will perhaps increase a little as time goes by.

So, after taking those things into account, we adopt what we consider to be a reasonable head to design the turbine for. In this particular case it is our judgment that 550 feet net head on the turbine is not unreasonable for the High Mountain Sheep project.

Q. If I understand you correctly, then, that is a judgment determination based, among other things, upon your drawdown determination. Is that correct?

A. Oh, yes, very, very definitely.

Mr. Sander: Mr. Examiner, I have one clarifying question if I may.

Presiding Examiner: Certainly.

Mr. Sander: I gather from your testimony that the critical head, rated head, and net head are rather synonymous. Is that correct?

The Witness: Not net head. In other words, I think I testified yesterday that, insofar as my use of terms is concerned, I consider design head and rated head and critical head that Mrs. Cooper has referred to, as being more or less one and the same.

[fol. 3291] Mr. Sander: Thank you.

By Mrs. Cooper:

Q. Referring again to the data that you furnished to Mr. Bonin as mentioned on pages 284 and 285 of the transcript, what peaking capability did you assume for the Lower Canyon project per unit?

A. I again determined somewhat along the same lines that I described for High Mountain Sheep, that the design head for the Lower Canyon project also would be appropriate at 550 feet, and therefore the turbine is the same that Mr. Bonin had for the High Mountain Sheep. Therefore the 200 megawatts is the capability of the Lower Canyon unit. They are identical units.

Q. If I understand you correctly, then, you determined

a critical head for Lower Canyon the same as High Mountain Sheep?

A. Considering pretty much the same general factor that I somewhat described a while ago.

Q. And that is 550 feet net?

A. Yes, in my judgment that is not unreasonable.

Q. Then what reservoir elevation would this critical head at Lower Canyon correspond to after China Gardens is in operation?

A. That again would be—I believe it would be mathematically the same numbers that I gave for High Mountain [fol. 3292] Sheep, inasmuch as we are starting from the same general tailwater.

Q. Again if you had larger generators at Lower Canyon, you would have greater peaking capacity above those heads, wouldn't you, Mr. Alspaugh?

A. That would be true. There is a limit, however, to how big generators you can put on that turbine.

Q. Would you tell us what the limit is?

A. I think you would consider a different runner. In other words, increase your design head on the run.

Q. We were talking generators, weren't we?

A. Yes. You can put a generator higher, but whether or not the runner would produce any power would be another question.

Q. Mr. Alspaugh, at Lower Canyon isn't the capability of the turbines greater above critical head than it is at critical head?

A. That is true, yes.

Q. And doesn't it follow, then, that the same turbines can drive larger generators than you provided for above critical head?

A. I think maybe to help you in this particular matter, what I had in mind in my reply a moment ago is, if you select a higher design head and the specific speed of the runner is different, and thereby your turbine is slightly [fol. 3293] different and you would design the turbine structurally to produce greater horsepower. You would have to

have a larger shaft. Your runner would have to be somewhat designed a little differently.

If you did that, then you could put bigger generators on that particular runner.

Q. Is that really necessary, Mr. Alspaugh? Or can't you install larger generators without changing the design of the turbine?

A. I would say that you would have to beef them up or do whatever the turbine manufacturer has to do. It is just like anything else that you design. You design a bridge for certain loading. Certainly if you increased the loading you would alter certain members.

I think possibly you can operate within a very small range. This is an overload factor and you are operating in what you call the safety factor range where you do just that. I think that is outside the design area.

Q. Mr. Alspaugh, is the horsepower of the turbines at Lower Canyon at critical head?

A. I think they are rated—Mr. Bonin testified to that. As I recall in his testimony, they are rated at 285,000 horsepower operating at 150 rpm, I believe.

Q. That was your testimony, wasn't it, Mr. Alspaugh?

A. It is also in that Table 2, is it?

Q. Yes, in Exhibit 18.

[fol. 3294] A. That indicates 285,000 horsepower, as I recall.

Q. That's right.

A. That is what we call the rating of the runner.

Q. What is the horsepower of the turbine at elevation 1595 at Lower Canyon, Mr. Alspaugh?

A. Tailwater 940? I will give you a theoretical horsepower, approximately.

Q. Would you rather give us that after the recess, Mr. Alspaugh?

A. Just let me try for a moment. If I can run a slide rule, I think I can.

Using three halves, which we often do in this type of problem, I would say it is 365,000 horsepower. The theo-

retical horsepower would be 365,000. We had better check it, though, later.

Q. How large a generator would be determined with that horsepower drive?

A. I would certainly want to check the manufacturers whether this turbine could be built and operating at what speed before I would want to answer your question. But I will make the arithmetical calculation, I think, that you are looking for.

Well, that is just a matter of converting to horsepower and using about a 97 percent generator efficiency. That would work out about 255,000 kilowatts.

[fol. 3295] Q. Did the establishment of the critical head at Lower Canyon represent the same judgment kind of determination that you described—

A. By and large, I think I indicated that a moment ago that that was true. There are some other factors if you wish me to enumerate them.

Q. As to Nez Perce, Mr. Alspaugh, what peaking capability did you assume there per unit?

A. Comparable in number to the 200 megawatts, 190 megawatts.

Q. What critical head?

A. Comparable to the 550, I used 530.

Q. What reservoir elevation did this critical head correspond to after China Gardens is in operation?

A. Operating China Gardens at 925—it would be again with about a 4-foot penstock loss—the pool level should be 1455 and operating China Gardens ranging down to 905, it would be 15 feet lower, or elevation 1440.

I think those would be comparable to the calculation that I gave you for High Mountain Sheep and Lower Canyon.

Q. Again, if you had larger generators at Nez Perce, you would have greater peaking capacity above those heads, wouldn't you?

A. If the turbine was designed to do just that.

Q. Would you tell me, Mr. Alspaugh, what the horse-
[fol. 3296] power capacity of the turbines at Nez Perce would be at critical head?

A. I am using again the same figure that you have in that table for Nez Perce, which I think is 3 or 4—Table 3—271,000 horsepower. Table 3, is it?

Mr. Hugh Smith: Two.

By Mrs. Cooper:

Q. Would you supply for the record at your convenience, Mr. Alspaugh, the horsepower capacity of generators at Nez Perce at elevation 1510?

A. On the same basis that I did for Lower Canyon at 1595?

Q. Yes, sir.

A. Yes, I can.

Q. I meant the capacity of the turbines—not the generators.

A. Yes.

Q. Am I correct in assuming that the establishment of the critical head at Nez Perce represented the same judgment kind of determination that you have described in connection with High Mountain Sheep?

A. Yes. As a matter of fact, that is one of the reasons why we were very careful in using our four-point system, assuming the three projects coming into being and operating in the same system at different times. And through [fol. 3297] the routing studies we were able to determine what we considered to be a reasonable operating criteria for these different periods of time and thereby adopt comparable reservoir levels which then resulted in adoption of these particular heads.

Q. Again am I correct in assuming that that judgment as to Nez Perce was based, among other things, on your drawdown determination?

A. Very definitely.

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[fol. 3301] By Mrs. Cooper:

Q. I refer you again, Mr. Alspaugh, to page 288 of the record, lines 11 through 13, and ask you how the operation of High Mountain Sheep would affect the flows at Lime Point.

A. When you are storing water, you reduce the flows at Lime Point, and when you are releasing water, you [fol. 3302] increase them.

Q. Can you tell me how you contemplate the operation of High Mountain Sheep in terms of your last statement?

A. I contemplate that we will be operating pretty much within whatever are the restrictions that are prescribed in our license, if granted, along the lines recommended by the Corps of Engineers.

I think they have been placed in the record under the Chief of Engineers' letter described as PNPC Exhibit 6.

In general, it says that, when required by the Corps of Engineers, they would like to have maintained on the river, I believe it is by and large an average flow between Lime Point lowest and 16,500 cfs as a minimum.

On the other hand, during the refill seasons they would require, if navigation required it in their judgment, that we operate on the basis of storing water at Mountain Sheep so to not reduce the flow at Lime Point or in that same range below 13,000 cubic feet per second.

This is all conditioned on the determinations of the Corps of Engineers as to their responsibility and what we should maintain for navigation. We operate our project in multi-purpose use in that manner.

Q. Referring again to Table 9 of Exhibit 17, Mr. Alspaugh, you show 708,000 average kilowatts at High Mountain Sheep in December 1936, with a peak capability [fol. 3303] of 977,000 kilowatts, do you not?

A. That is correct.

Q. How would the High Mountain Sheep project operate on a daily and weekly basis during that month?

A. It would be on extremely high load factor operation.

Q. What would the minimum hourly output be during the month?

A. I think the minimum hour would be a function of the sixteen and a half thousand Lime Point. I am just merely trying—it would depend on the Salmon River run-off. In other words, the Salmon River, as I mentioned earlier, will vary between 3,000 and 5,000.

In fact, this particular month you indicate, I think the Salmon River itself was running—I will answer it this way.

The Snake River flow under natural conditions is 23,650 and the Mountain Sheep flow is 20,560. That would indicate the Snake River had 3,090 cfs. 3,090 cfs from 16,500—we will call it 3100—we should have an outflow at minimum hour for Mountain Sheep of 13,400.

I can tell you the answer in just a minute.

December 1936, in this particular reading study, the High Mountain Sheep project was operating with an average K. factor of about 41.3. At that time, 16,500—which we would assume in this case to have been required by [fol. 3304] the Corps, would give you a minimum output of 680 megawatts.

Q. Is it true, Mr. Alspaugh, that during the winter months the minimum output would be of that relative magnitude?

A. I think that we ourselves have frequently assumed that it is not unreasonable to expect the Salmon River to be a somewhat higher discharge than this particular amount.

In this case, it is 3,100. If it is 5,000, that would mean that the flow at Mountain Sheep could be reduced to 11,500.

And if we are in this neighborhood of pool level that I just indicated for December 1966—and we are generally in that neighborhood—I would say that we would normally operate the plant with a minimum discharge of 11,500, unless navigation conditions did not require it and the minimum output thereby would be approximately—that

would reduce it to 470 megawatts, which would be the minimum output of the project.

Q. Once China Gardens is placed in operation, Mr. Alspaugh, would you operate much differently with five units installed in High Mountain Sheep?

A. In that particular month we mentioned—December 1936—if it were to be assumed that we did have five units when China Gardens was built, we couldn't operate too much differently. We would operate to a limited amount.

Q. And you would still operate at a pretty high load [fol. 3305] factor, would you?

A. It is rather evident that to get the energy out in that month you have to get a high load factor.

Q. What is the pondage at China Gardens?

A. The pondage at China Gardens in the Mountain Sheep plan between elevation 945 and 930, which we consider to be minimum pondage level, is approximately 20,000 acre-feet.

[fol. 3306] Q. Would China Gardens operate for peaking purposes?

A. It would swing. In other words, it would swing to maintain the leveling-out effect, again required by the Corps of Engineers in the interests of navigation, which at the moment they have suggested somewhere below Lime Point the river should be controlled so as to not—it is a foot one way and a foot and a half the other—so as not to exceed a rate of one and a half feet per hour on the rising stage and one foot per hour on the falling stage unless otherwise approved by the Corps of Engineers.

Q. Referring to Table 2 of Exhibit 18, Mr. Alspaugh, would you operate China Gardens to peak to 300 megawatts?

A. I think so, yes.

Q. Wouldn't that mean that China Gardens would have to operate on a peaking schedule?

A. That's right.

Q. On that peaking schedule, would you expect releases from China Gardens to vary widely?

A. They would vary within this limitation that I spoke of a moment ago if the river is in its natural state between Lime Point and Lewiston. You would have to operate China Gardens to maintain what the Corps of Engineers would require if required for navigation, and your peaking of China Gardens, like any other run-of-river project, is a function of the amount of pondage you had and a function [fol. 3307] of the amount of water you are releasing from the storage reservoir above you. And also related to your load as to when you require that 300 megawatts.

Q. Would you anticipate that with China Gardens in operation you could shut down High Mountain Sheep project completely on week-ends?

A. Well, you have got to maintain on an average of 11,500 cfs over the week-end, if required for navigation, and certainly not less than 10 as required by fishery interests, and probably recreational interests.

So if we took even the minimum of 10,000 cfs, 10,000 cfs for 24 hours is 20,000 acre-feet, which is equivalent to the pondage at China Gardens.

I for one believe that this 20,000 acre-feet of storage that we have at China Gardens for pondage is the very minimum, and for that reason we are limited on your week-end operation. We would have to operate the storage project a few hours, certainly on Saturday, and maybe a few hours on Sunday even. If the Salmon River was six or seven thousand, it would help you a little bit, but it is not often at that point.

Q. How many hours? Do you have any idea, Mr. Alspaugh?

A. The discharge of the Mountain Sheep project with five units initially. However, in our particular case in our [fol. 3308] comparable study we have seven units with a discharge of around 35,000 cfs from the High Mountain Sheep project. Certainly we wouldn't have to operate more than two or three hours on either day.

I can compute that for you, but I have not done so. It is just a matter of getting enough water to keep the flow to

the basic minimum of 10,000 and perhaps 11,500, or whatever might be required.

Q. Let me ask you whether you would anticipate that, with China Gardens in operation, you could shut down High Mountain Sheep completely overnight?

A. That is about all—oh, yes, you could do that because that is only 12 hours. That would only require 12,000 acre-feet of storage if you were operating on the basis of 10,000.

Q. Would that be your normal operation?

A. Oh, I think that we would consider, if the load factor of the plant is in the neighborhood of—monthly load factor is in the neighborhood of 60 percent, we would keep perhaps around 70, and daily around 75 or 80, and normal operations on the rest of our system—that is, the organizing company systems—that we would shut down to the minimum output by eleven o'clock at night and probably bring the plant on somewhere around six or seven o'clock in the morning and bring it up to whatever peak we would [fol. 3309] need by eleven and drop a little in the afternoon and swing back up in the evening peak, if that would be necessary.

That is the general type of operation that I would visualize. Certainly we would go down to minimum between midnight and six.

Q. Would the pattern of operation which you just described on a daily basis hold, for example, Mr. Alspaugh, for the month of December, 1936-37 as shown on Table 9 of Exhibit 17?

A. I don't think so.

Q. Referring to the transcript at page 293, lines 15 through 18, you state there that China Gardens is economically feasible. Will you explain the basis for that statement?

A. I think Table 1, Exhibit 19, line 7, would indicate that the benefit to cost ratio is approximately 2.62 to 1. That to me indicates it is economically feasible.

Q. That is under the High Mountain Sheep plan. Under the Nez Perce plan it is 2.29 to 1. Is that correct?

A. That is correct.

Q. Therefore it is fair to assume, is it not, that your statement of economic feasibility is based on your studies of output in Exhibit 18 and your computation of power value, Exhibit 19?

A. That would follow.

Q. Would you refer, please, to page 294 of the tran-
[fol. 3310] script, lines 15 through 19. You state there that the annual value of the prime engineering at Whitebird would be $1,200,000. Would you tell me how you arrived at that figure?

A. I replied to that to Mr. Riley yesterday.

Q. Are you referring to page 3241 of the transcript?

A. I think that is correct. I believe my reply I give there is adequate. Do you want me to restate it?

Q. I just wondered if that was the statement you are referring to.

A. Yes, that is in substance what I would give you again.

Q. What is the peaking capacity of Whitebird, Mr. Alspaugh?

A. If you have enough water and enough pondage, you would get 60 megawatts under certain head conditions.

Q. Do you have sufficient pondage, Mr. Alspaugh, to peak Whitebird at 60,000 kilowatts?

A. That is one of the reasons why I have not used 60 megawatts peaking at Whitebird because, without storage above it, your flows during the critical peaking operations are such—3,000 cfs, for example—that with the pondage available which you have used, ten feet, in my opinion it will not support 60 megawatts of capacity.

Q. Will you explain, Mr. Alspaugh, how you determined
[fol. 3311] the annual costs of Whitebird?

A. As indicated in my direct testimony on page 294, I obtained from Mr. Bonin the cost of the Whitebird project to be $36 million without interest during construction. And based upon his—I believe it is a three-year construction period, I would have to check that. But however, be what it may, I calculated interest during construction and added that to the $36 million to obtain total investment cost of $37,425,000. I applied interest and amortization on that

figure, plus the operation and maintenance, administrative and general, and allowance for interim replacements, to arrive at a figure of $1,502,000, and I rounded it to $1,500,000, which I testified to on page 294.

Q. At your convenience, Mr. Alspaugh, could you supply for the record the figures that you used in arriving at the $1,500,000?

A. I could read them into the record right now if you wish. Interest and amortization on the $37,425,000 investment, which I used is $1,320,000. Operation and maintenance, $52,000. Administrative and general, $18,000. Interim replacements and insurance, $112,000. Totalling $1,502,000, which I rounded to $1,500,000.

Q. So that if the construction cost of Whitebird were less than $36,000,000, your benefit cost ratio would be higher, wouldn't it?

[fol. 3312] A. That would follow.

Q. Who established the unit size at Whitebird?

A. Again this is jointly. I provided to Mr. Bonin the general requirements of the hydraulic capacity for the Whitebird project, being in the neighborhood of 25,000 cubic feet per second, and he in turn selected the runners to adapt themselves to that particular hydraulic capacity.

In this particular case we jointly, or he suggested three runners, not large kaplans, when you take into consideration the problem of time periods and when the project may operate.

Q. Referring now to page 295 of the transcript, line 8, you state, Mr. Alspaugh, that the Whitebird economics would be improved at such time as the Crevice project is constructed.

A. What line is that again, please?

Q. Beginning with line 8 through line 11.

A. I see.

Q. Then in lines 11 through 16 you refer to the Division Engineers' statement regarding the Crevice location in the wilderness area.

Does that same report determine the benefit to cost ratio of Crevice?

A. Yes. I think that is an item that was stipulated with respect to, as I remember, in San Francisco,—excuse me, we stipulated the cost of Crevice. I believe in direct an- [fol. 3313] swer to your question they do have—I am certain they must have a BC ratio in there for credit.

Q. Would it refresh your recollection for me to tell you there is a justification ratio of 2.31 as a unit and 800,000 cfs flood control plan, and 1.95 as a unit in 600,000 cfs flood control plan?

A. I think if I remember what you are referring to, and if those are the numbers, I imagine that is correct.

Q. Would you want to verify that, Mr. Alspaugh?

A. Yes, I can do so.

In the Division Engineer's report they show a justification ratio 2.13 on what they call the basic flood control plan, and 1.79 subsequent to basic flood control plan, page 276. I don't recall whether those are the figures you just recited.

Q. Mr. Alspaugh, doesn't page 276 refer to Lower Canyon?

A. Excuse me. Strike all that.

The Crevice project: beginning on page 267 of the same report and on page 271, there is a table—not a table either, it is actually in the text. I will read the quotation from the report "Total project accomplishments would amount to $18,574,000 or $15,662,000, depending on the time of construction. Comparison with annual cost of $8,039,000 indicates a justification ratio of 2.31, or 1.95."

[fol. 3314] That is from page 271 of the Division Engineer's report.

Q. You have testified, Mr. Alspaugh, that you could not determine when the Crevice project would be placed in operation because of its wilderness area location and the fish passage problem. Have you studied the fish passage problem at Crevice?

A. No, I have not.

Q. Do you know of your own knowledge whether it would be comparable to the fish passage problem at Lower Canyon?

A. I would only assume, being further upstream, that there would be some difference.

Q. By that, do you mean it might be less than at Lower Canyon?

A. I don't really know. I have heard and discussed running out spawning areas and blocking the middle fork of the Salmon, I think it is. I don't know whether it would be more or less.

Q. Have you made a study of the effect of Crevice on the wilderness area in which it would be located?

A. No. I think in reply to Mr. Riley's question yesterday, I said I did not. My remarks were taken, based on the Division Engineer's report.

Q. So it is fair to conclude that, as of your own knowledge, you don't have any facts on which to judge whether [fol. 3315] a delay of Crevice beyond Lower Canyon's completion would be probable, do you?

Mr. Hugh Smith: Mrs. Cooper, may I inquire: Is Washington Public Power Supply System proposing to construct Crevice?

Mrs. Cooper: It seems to me to be an irrelevant question, Mr. Smith.

Presiding Examiner: Yes, it is an irrelevant question. You proceed, Mrs. Cooper.

The Witness: Could I have the question reread?

(Question read.)

A. I don't think it is fair to conclude I have no facts. Certainly I am aware over the many, many years that the agencies involved in the study of the Salmon River have always placed the Crevice project on a time schedule much later than the area which we now have under study.

I again lean rather heavily upon the recommendations of the Division Engineer, in which case he did not place the Crevice project in the major water plan that he saw fit to recommend in 1958.

Presiding Examiner: Is that the Division Engineer's plan you refer to, the 1958?

The Witness: It is June 1958.

By Mrs. Cooper:

Q. Do you know, Mr. Alspaugh, whether there have been [fol. 3316] any projects on the Columbia River that have been constructed that have not been included in the plan of the Army Engineers?

Mr. Hugh Smith: I object to that question.

Presiding Examiner: I sustain the objection.

By Mrs. Cooper:

Q. Would you refer to page 302 of the transcript, lines 16 through 25, particularly the statement "that the purpose of my study was to establish a sound engineering basis for comparing potential power development of the resources involved by the two alternative plans."

Is it fair to conclude from your testimony that your assumed delay of construction of Crevice would not be due to an engineering factor?

A. Well, as I indicated yesterday to Mr. Riley, my answer why I delayed Crevice was given in my direct testimony. If I were to consider Crevice, I think that I should give consideration to—it was not 35 projects I had in mind. I looked them up last night and there were only 29 projects above Crevice project.

There are many of those that might be in the same category as the Crevice project. So it gets into the question of what is reasonable in setting up your comparative studies.

Q. Isn't it true, Mr. Alspaugh, that Crevice is more [fol. 3317] nearly comparable to Lower Canyon than the 29 additional projects upstream from Crevice on the Salmon?

Mr. Hugh Smith: That is an argumentative question, Mr. Examiner. I object to it.

Presiding Examiner: I will permit the question.

A. I know of four or five that approach it in size and storage and so forth.

By Mrs. Cooper:

Q. Those other four or five projects are not shown on your exhibits, are they?

A. No, they are not.

Q. Let me repeat, Mr. Alspaugh: Would the delay of Crevice be an engineering factor or not? Let me state it more precisely: Would the delay be based on an engineering factor?

A. Perhaps only to this extent, that as you, you might say, catalogue projects in the area, engineering factors do go into consideration of their relative position, I presume, from economic point of view with respect to one another. To that extent, I suppose an engineering factor would be part of the parcel. Primarily Crevice is not in the engineering factor area.

I know of excellent projects in the Northwest that can't be built on account of other factors than engineering.

Presiding Examiner: I am a bit confused at this point. [fol. 3318] Am I correct in my assumption that in making your comparable engineering study of power potentials, that you excluded the time delay factor?

The Witness: In so far as the projects are concerned and what we described yesterday as the common reach. In other words, I took into account time delay factors—

Presiding Examiner: That is what I understood—

The Witness: —at those projects. The time delay factor only has to do with other projects above and below the common reach.

By Mrs. Cooper:

Q. Crevice and Freedom—

A. Freedom is part of the common reach.

Q. Crevice is above?

A. Crevice is above, and Asotin is below, for example.

Q. If you were to take into account only engineering factors, Mr. Alspaugh, wouldn't it be logical to include Crevice, Freedom and Whitebird in your analysis?

Mr. Hugh Smith: I object to that as argumentative and not related to this witness' testimony.

Presiding Examiner: I will sustain the objection to that.

Mrs. Cooper: Mr. Examiner, I am puzzled both by the objection and the ruling, if you will bear with me a moment. This witness has testified both as to Crevice and Freedom, [fol. 3319] and also to Whitebird, and he has dealt with them in various ways in his study. They are certainly related to his analyses.

Presiding Examiner: But he, as I understand it, has testified that these comparable power studies encompass only the projects included in the common reach, and you are asking him to make a hypothetical comparison which is not within his direct testimony.

I don't know the basis of Mr. Smith's objection, but this is the basis of my ruling, that it is outside the scope of his testimony and based on a hypothesis which has not been established in this proceeding.

Mrs. Cooper: I beg to differ with you, sir. That is not the case. In the first place, the Crevice releases do affect the storage output downstream. This witness in his power routing studies has taken into account the Crevice project.

By Mrs. Cooper:

Q. Am I not correct in that, Mr. Alspaugh?

A. I testified to this extent. I did not take them into account in my power routing studies in my Exhibit 18. I did testify in my direct, had I taken them into account, the improvement in the Nez Perce plan would have been some, but not sufficient to alter my conclusions as to the comparability of the two plans.

Q. I am correct, am I not, Mr. Alspaugh, that you testi- [fol. 3320] fied as to the effect of Crevice on both of your plans, both your High Mountain Sheep and your Nez Perce plan?

A. The only testimony I recall with respect to Crevice—

Q. Refer to page 290, Mr. Alspaugh, beginning with line 23.

A. This is on the supposition that if it should come in —if it should come in in the period of time, this time factor we were talking about, if it should come in at any time, it would have some effect. I did not in my Exhibit 18 have any power routing studies that dealt with the Crevice project as such.

Q. But you did have power routing studies to get the figure in line 25 on page 311, did you not, and the figure in line 1 on page 312?

A. I made such a power routing study on certain assumptions to arrive at an amount to estimate, and I think I estimated these amounts that you speak of.

Q. In order to finally clarify this point for the Examiner, it is also true that you took into account the Crevice project in evaluating the economic feasibility of Freedom and Whitebird, is that not true?

A. Well, I took it into account in the fact that I stated that Whitebird was not economic without the Crevice project, and likewise I stated that the Division Engineer's report so indicated with respect to Freedom.

[fol. 3321] Q. Against that background, if the Examiner please, I would like to repeat the question previously asked: Taking into account, Mr. Alspaugh, only engineering factors, would it have been logical to include the Crevice, Freedom, and Whitebird projects in your analyses?

Mr. Hugh Smith: I renew my objection.

Presiding Examiner: I will make the same ruling, Mrs. Cooper. I think your question is a hypothetical one. You are asking him to do something he didn't do, and then asking him to make comparisons on that basis.

Mrs. Cooper: I am not asking for any comparisons. I am asking him, if he were to apply the criteria which he describes in this testimony, namely, the engineering factors, whether it would have been logical to have excluded the Crevice, Freedom and Whitebird projects in his analyses. That is not a hypothetical question.

Presiding Examiner: It is still asking him whether it would have been logical, which as I say gets into this hypo-

thetical, argumentative aspect. You make the assumption and ask him what the effect would be. Perhaps you could rephrase your question.

[fol. 3322] By Mrs. Cooper:

Q. Assuming consideration only of engineering factors, Mr. Alspaugh, and taking account of the B/C ratios for Crevice to which you have just recently alluded, would you consider Crevice to be a feasible project?

A. By the term of "feasibility," if it should have a justification ratio greater than one, I would assume that would meet the test.

Q. In your 1984-85 studies, I think you testified this morning that you had something in the neighborhood of eight million kilowatts of steam in your studies?

A. I think that was correct.

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[fol. 3326] Mr. Hugh Smith: I think we are going to have some confusion around the word "plan" of development, Mr. Examiner, that has been used. It is obviously somewhat loose. But as we have used "plan" in the alternative plans, we have been referring to the alternative physical resources.

These physical resources—the major items of course are the three projects: Nez Perce, Lower Canyon and High Mountain Sheep—are affected by developments outside of the common reach. They are, as certainly is going to become clear, going to be affected in their potentials by developments as far away as Canadian storage. They are [fol. 3327] affected by Libby storage. They are affected by diversion of irrigation waters in the Snake River above this area. They are similarly affected by Crevice.

Presiding Examiner: Am I clear in my assumption that Crevice is outside of what we have been talking about as the "common reach"?

Mr. Hugh Smith: That is correct, sir. The common reach has been stipulated, and Crevice is upstream. The common reach extends—

Presiding Examiner: Does it include Whitebird?

Mr. Hugh Smith: It includes Whitebird. It is defined as the Freedom pool level on the Salmon River, the China Gardens tailwater below that, and the Hells Canyon pool level on the Snake River.

The reason why Hells Canyon and Freedom are included in the common reach is because of the overlap. Both plans overlap on Hells Canyon and overlap somewhat on Freedom, and they have a variable overlap.

In order, therefore, to have the figures complete to show what the alternative powers are, you go up to this elevation, which is common in both cases. That is the common reach.

Crevice is outside of the common reach. At such time as Crevice is constructed, the effect is, in effect, to move some of the storage from here up to Crevice, to use it here [fol. 3328] rather than here. That has a variable effect on the plan.

As Mr. Alspaugh has already testified, it tends to substantially narrow the gap between the two plans to the advantage of the Nez Perce plan. It brings it closer to the High Mountain Sheep plan.

The question, therefore, on the type of analysis that Mr. Alspaugh has made, which is a four-point analysis over 50 years, is that in what year do you drop this in, because obviously it makes quite a difference on the total of the 50-year run.

Our position, which Mr. Alspaugh has testified to, is that on the basis of this project your probable construction agency, in view of the fact—well, your probable construction agency is going to be the Corps of Engineers. It is the only one around at the moment.

The Corps of Engineers have indicated that for two reasons—fish and the wilderness aspect—they have not recommended Crevice. This puts this, from our point of view, in a doubtful status. For that reason we do not find a justification for putting it in at a specific year in the analysis.

WPPSS, for the reasons that become clear, would like to have Crevice in.

I could state right now my position is, that if they can prove a logical year when you can assume Crevice in [fol. 3329] being in view of the facts that we know, then that is the year it ought to go into the analysis.

That, it seems to me, is the major issue that is involved here. We have made a certain presumption, and Mrs. Cooper would like to make a different one.

Presiding Examiner: Mrs. Cooper.

Mrs. Cooper: In this connection, just for clarification with respect to the stipulation as to the common reach, we did try to get Crevice included in the common reach and the company refused to accede to its inclusion.

As Mr. Smith has pointed out, Crevice does have more of an effect upon the storage operation of Lower Canyon than it does on Nez Perce.

I think maybe some of the confusion here may be arising out of the use of the term "common reach." The plan of development in terms of the—

Presiding Examiner: I take it what you are saying is that the plan of development is not limited to the common reach?

Mrs. Cooper: In terms of the statutory standard.

Presiding Examiner: I now understand that. Before, I had assumed that the two were coextensive. So I am very appreciative to counsel for clarifying this business for me.

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[fol. 3364] Mrs. Cooper: Mr. Examiner, I am attempting to test the validity of his assumption of 2½ percent interest.

Presiding Examiner: Why don't you ask him the basis on which he assumed 2½ percent interest?

By Mrs. Cooper:

Q. Would you care to answer the Examiner's question, Mr. Alspaugh?

A. In my comparative studies I have used 2½ percent interest to determine the scope of the projects. That is what is being done in the Northwest by the Federal agencies in determining the scope of what these projects should be constructed to, and the value of power is by and large—I shouldn't say it is based on that exactly, but certainly it is a factor involved in it.

In particular I would make reference to pages 11 and 12 of Exhibit 19, which indicated to me what the going rate of interest would be applicable to water resource development by Federal agencies.

Q. Would you explain the relevancy of the cost of money for Federal development to the projects here under con-
[fol. 3365] sideration?

A. Well, insofar as my particular comparative studies are concerned, I have adopted the construction cost provided to me by Mr. Bonin and have used from there on the 2½ percent interest in developing an investment cost for the purpose of evaluating the two plans.

Now, likewise in determining the scope of the feature of a project, be it the overlap problem or the economic pool level or tailwater excavation or anything like that, I have followed the same criteria that I think is being followed in the Pacific Northwest.

In other words, when the Corps of Engineers recommend a pool level to be 1510, I believe you have to follow the same general criteria as followed by the Corps. Otherwise, you would arrive at a little different number.

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[fol. 3370] By Mrs. Cooper:

Q. Given Mr. Bonin's estimate of $3 million added cost for the 20-foot incremental height at Lower Canyon, would the annual cost based thereon, if constructed by PNPC, be in the neighborhood of $300,000?

A. I actually don't know, other than the fact that if you take the 9 percent that you are speaking of, multiply 9

percent times 3 million, you get $270,000. The arithmetic, I guess, is such that it would be.

Q. Then you would have to add interest during construction, would you not?

A. Yes. But I would qualify what I say because in my comparative studies I have been very careful to analyze all components of all projects so that if I should do this to this project I would feel that I should do this to the other projects. In other words, I have attempted to establish the pool levels on a comparable basis.

Actually, I personally feel that the ratio that I obtained I understate the height of the Lower Canyon project on the [fol. 3371] Freedom project. In other words, I think we are on the conservative side with respect to overlap. If anything, we should be higher perhaps another 10 feet.

These are factors which you get involved with when you try to set comparable elevations for these respective projects.

Q. If PNPC were to construct Lower Canyon, in order to justify the added height, it would have to compare its own benefits to its own costs, would it not?

A. It certainly would, and from what I know I certainly as an individual would recommend to the company to construct it to that level and actually I would consider a higher level.

Q. Is your last statement based, Mr. Alspaugh, on computations which you have made of the B/C ration for Lower Canyon for the added height, 20 feet at Lower Canyon, based upon construction and financing by PNPC?

A. In general. I think that even at the figures that you cite we still would be in the position of saying that from the scope of over-all development we still would have excess benefits over cost, even to an individual, be it PNPC or to yourselves, say, such that I think that any additional storage. All these factors are taken into account in arriv- overlap storage. That is, in my opinion, quite valuable amount that you constructed, you get more what we call ing at the pond level.

We basically, if you recall, and we are 1490 on both [fol. 3372] Mountain Sheep and Nez Perce, we were 1575 on Lower Canyon. When we raised to 1510 on those two projects, we likewise raised it to 1595, knowing very well if anything we could go higher. So we feel we are conservative on this particular pond elevation.

Q. I am correct, however, am I not, Mr. Alspaugh, that your last answer was made without benefit of precise computations of benefits and costs?

A. I have actually run, insofar as benefits are concerned, studies on pool levels 1575, 1585, 1595, 1590, 1595, and know that if I were to run additional heights I can extrapolate the data and not what I get in the way of benefits. I also have been advised by Mr. Bonin as to what I would expect in the way of costs for the additional height, and it is based on those factors that I make the statement that I made—that I feel we are conservative at this particular pool level with a 35-foot overlap.

In other words, you can overlap a dam on the Salmon River because you don't lose the power on the project, more so than you can on the Snake River. It is for those factors that I make my statement.

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[fol. 3389] Q. Do you know of any time, Mr. Alspaugh, when two dams would be more efficient than one dam for controlling the flow of these two rivers?

A. Well, I can reply with respect to what the Corps of Engineers do in regard to flood control benefits, that when you get the control of the river down to, say, 600,000 cubic feet per second, the Corps of Engineers use 2,200,000 acre-feet of water on the Snake River to control it, and in the case of Lower Canyon project they would use the full 3,265,000, which together is 5,365,000 acre-feet of storage as contrasted to the use of 5,000,000 acre-feet of storage at Nez Perce, and thereby the two dams under those conditions would control the river at The Dalles to a smaller amount than would the single dam.

Q. What would your answer be, Mr. Alspaugh, in terms of the controlled 800,000 cfs at The Dalles?

A. I think that I would again answer—

Mr. Hugh Smith: I think I will object to that question [fol. 3390] because it seems to me he was cross-examined on that in the previous question. What Mr. Alspaugh was asked on the previous question was to state the circumstances under which the two dams would be more efficient. I think this question is argumentative.

Presiding Examiner: Isn't there testimony somewhere in this record with regard to alternate engineer's control figure of 800,000 cfs at The Dalles?

Mr. Hugh Smith: I don't doubt it. There is no question about that, Mr. Examiner.

Presiding Examiner: I will permit him to answer the question.

The Witness: As I started to say, I think I would refer you again to page 10 in Exhibit 19 and again use the Corps of Engineers' figures, wherein on a benefit basis the benefits credited to the High Mountain Sheep plan under the second condition there, 81, that the 6,560,000 is contrasted to the benefits credited to the Nez Perce plan of 6,500,000 dollars.

Now, I do not know exactly in acre-feet the relationship that the Army is using for the High Mountain Sheep plan in the controlled 800,000. I do think it is in the neighborhood of 1,800,000 or 1,900,000. This requires a shorter time period for control. At Nez Perce they are using the five million. Likewise they are using 3,265,000 for Lower Canyon. I can only conclude that they themselves have [fol. 3391] indicated that the two dams would provide a better control than the single dam.

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[fol. 3404] Q. Have you related the dollar value of this incremental storage use in your sheet @-14-F for WPPSS Exhibit 96-F?

A. Yes, this sheet 14-F indicates the comparison of value and cost for incremental storage use at the Lower Canyon project.

Q. Would you explain this sheet, Mr. Alspaugh?

A. I am trying to think of a simplified way of indicating what it shows without going into detail too greatly. This sheet indicates the method by which I have measured the amount of power that would be obtained by using the 600,000 acre-feet of storage at Lower Canyon and recognizes the value of that storage for flood control in arriving at the benefits that I in this particular analysis have indicated as what I think is reasonable for the use of that storage.

I have also indicated what that storage does with respect to downstream projects and have employed a method, of which there are many others, to indicate the costs that I would associate with that use of that storage, and arrived at a ratio of what I call incremental value to incremental cost as one of my factors in—it is my economic factor to a certain extent—it is the economic factor, let's say, in the year 1968, in support of my decision to use 3,265,000 acre-feet of storage at the Lower Canyon project or establish the minimum pool level I have referred to earlier.

[fol. 3405] Q. Do I correctly understand, then, that for the period 1967 to 1975 you obtain a power benefit from the release of the additional storage at Lower Canyon?

A. Yes, I think I indicated that.

Q. Is this based on a storage control period of eight months?

A. Yes, that is indicated again on Table 6 and 7, respectively, of Exhibit 18.

Q. If this storage control period were to be lengthened, this value would be reduced, would it not?

A. I think I answered yesterday that the trend would be in that way—in that direction.

Q. And your flood control benefit from the added storage at Lower Canyon would be $750,000, is that correct?

A. That's what is shown on this Sheet 14-F.

Q. Couldn't the project be operated with 2,665,000 acre-feet of storage for power purposes and still have available 3,265,000 acre-feet of flood control storage?

Mr. Hugh Smith: I object to that question.

Presiding Examiner: Would you read the question, please?

(Question read.)

Presiding Examiner: Are you talking about Lower Canyon?

Mrs. Cooper: Yes.

Mr. Hugh Smith: I object because this witness has so [fol. 3406] operated the project, and so analyzed the project in such operation.

Presiding Examiner: I will permit him to answer if he can.

Mr. Hugh Smith: Mr. Examiner, that just gets us into the realm of speculation. These are very complicated areas, sir, as I am sure you will understand.

Presiding Examiner: I don't know before the witness answers whether he has a figure at his fingertips or not. Suppose I let him answer the question. I am not going to direct him to make any computation.

(Question read again.)

A. I don't know. I have never known them to do that in the Northwest.

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[fol. 3408] By Mrs. Cooper:

Q. Mr. Alspaugh, couldn't you operate on a power rule curve with 2,665,000 acre-feet of storage and still not jeopardize the release of an added 600,000 acre-feet for flood control required by the Army Engineers?

Mr. Hugh Smith: I think that is an improper question, Mr. Examiner. I object to it.

Presiding Examiner: I will permit him to answer it if he is in a position to do so.

The Witness: As I indicated before, to my knowledge it has never been done. The reason it is not done is that you are getting into capacity problems during the flood control season and therefore you have to take into account the losses of power as against the flood control benefits.

[fol. 3409] To my knowledge on these reservoirs in the Pacific Northwest, all the flood control is doing is merely using the storage that power has established. In other words, if you have established 2,600,000 acre-feet for power, flood control by and large uses it.

To my knowledge, I don't think they have ever used an acre-foot beyond that on these major storage reservoirs.

Mr. Sander: What do you mean by "they"?

The Witness: The Corps of Engineers.

* * * * * * *

[fol. 3443] Q. And your generator capacity was based upon the average head with use of 3,265,000 acre-foot of storage for power drawdown, was it?

A. 550 foot, which is the basis for our turbine design was based upon 3,265,000.

Q. And your generator installation would therefore be greater if the normal drawdown was less than 3,265,000, wouldn't it?

A. I think in this particular case we would find ourselves considering, and if you assumed that, to take into consideration what the effect on design head would be, and therefore if you have a higher design head, you would redesign your turbine and probably put—I don't know whether you would put a larger generator on or not. You would put—it wouldn't be any smaller. I assure you of that. It is just a question of how much larger it would be.

I think the turbine might be a little smaller.

[fol. 3444] Q. Was your testimony, Mr. Alspaugh, that you put in a smaller turbine with a greater head and a greater output?

A. Well, when you are getting back to the generator size, I think you are getting a little involved with what the capacity of the plant should be.

We have by and large put these plants on the same load factor. Another way of saying that is we are able to handle approximately 50,000 second-feet of water at Mountain Sheep and approximately 35,000 second-feet of water at Lower Canyon. Likewise, we are also able to handle approximately 85,000 second-feet of water at Nez Perce.

When you increase the head that you are speaking of, you increase the energy by whatever amount that might be. It would increase your generator size a little but I don't think the turbine—in other words, I am going to increase the design head from 550 as you say to 575. I think we would end up with a smaller turbine, but a slightly larger generator. I think that would be the real significance. The turbine physically might be just a little smaller.

This is a problem where, if you increase the head at Lower Canyon, you find you should increase the head at the other two projects. You have got to put this in balance and that is the key to this thing.

Q. How many units did you have in mind in referring to 35,000, 50,000, 85,000 cfs at the three projects?

[fol. 3445] A. Those are approximately sized by Mr. Bonin. They work out seven units at Lower Canyon and ten units at Mountain Sheep and 17 units at Nez Perce.

In other words, those units approximately take about 5,000 second-feet of water. Of course, it depends on the water.

Q. That doesn't refer to your 1975 studies, of course?

A. Oh, no, the 1975 studies have a lesser installation. That is correct.

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[fol. 3464] Q. Referring, Mr. Alspaugh, to page 276 of the transcript, lines 15 through 21, is it your opinion that the Mountain Sheep project and the Lower Canyon project and the Nez Perce project would be operated on a coordinated basis with the Northwest Power Pool?

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[fol. 3465] A. I was going to answer yes, but I did want to have it understood that the word "coordinated" as used by you, Mrs. Cooper, means coordinated or integrated operation in the Northwest Power Pool and not an isolated operation by an individual project. It is a fully coordinated, integrated operation.

By Mrs. Cooper:

Q. Such coordination requires the total pool operation will be such that total pool loads may be supplied. Isn't that correct?

A. That is right. It is operated as if you had one entire system as the Northwest Power Pool and operated to obtain the maximum amount of power in the area as a whole.

Q. Then any studies of the operation of these three projects must be related to the other resources in the Pacific Northwest and the loads in the region, isn't that right?

The Witness: May I have that question read, please?

(Question read.)

[fol. 3466] A. I think that would follow.

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[fol. 3475] Mr. Sander: For the record, I have just talked with Mr. Weinberger in the Department of the Interior and referred the request to him that you directed me to make. Mr. Weinberger said he will consider the request in the context of the transcript when he receives it tomorrow morning and wishes to consider it further.

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[fol. 3557] Q. Would you explain what you mean?

A. If I were going to follow the procedure that I think you are suggesting, I would relate the prime power I obtain from this particular project, both at-site and downstream, and indicate what the load carrying capability of this particular segment would be. If I were to do that, I would obtain this 6,338,000,000 kilowatt hour figure to go

with the High Mountain Sheep segment. The downstream segment, I think I testified to, was—I think it is 170 megawatts—which again related to load carrying capability. I would end up with the fact that, having built this particular project, I would be able to sell, or the market conditions would be such that you could sell, 7 billion kilowatt hours a year in the Pacific Northwest.

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[fol. 3564] By Mr. Sander:

Q. Could you give me just a little bit more of a description what you mean by short-cut? Why is this short-cut?

A. The reason for this is that it is almost impossible to manually run a complete system which involves some 150 projects. We do know, when we look at the system in the Northwest, that we can take out certain areas which will not affect the problem area that we are concerned with. The problem area, I might say, is the common reach area.

We generally find it readily easy to eliminate the Willamette Valley project. We find it readily easy to eliminate the coastal streams, Puget Sound and the Lewis River and so forth.

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[fol. 3566] Q. Just briefly for the record would you ex-
[fol. 3567] plain the factors which cause or have an effect on the downstream installations as referred to at line 8? We have been talking about the downstream effect, but I just want to get in the record actually what happens.

A. Actually what happens is by the use of the High Mountain Sheep storage you increase the release of water during the storage control period at the downstream projects and reduce the flow past the downstream projects while you are storing the water in what we call the runoff season. That has an effect on the downstream installations in that the downstream installations will have a greater

average prime energy, for example, and they in turn will be able to carry a greater load.

Q. Is that with or without additional units downstream?

A. Well, it may or may not be. In the particular situation in the Pacific Northwest today, by and large there is quite an adequate capacity involved in the downstream projects, particularly the McNary project and The Dalles project.

* * * * * * *

[fol. 3579] Q. In line 12 you speak of multi-purpose uses other than power. Would you just list those briefly?

A. Well, multi-purpose uses in most of these multi-purpose projects are quite numerous in some, and others, not quite so much. The main ones, of course, are flood control, navigation, recreation, pollution abatement, water supply and so forth, like that.

Particularly the latter ones are more important, of course. On the Snake River, the major ones are flood control, navigation and probably recreation.

Q. Is the value ascribed to these other uses in establishing a B/C ratio?

A. I have in my calculations of the B/C ratio—which basically is a yardstick for measuring benefits versus cost—used only power and flood control.

The Corps of Engineers, when asked as to what the navigation benefits might be along with our requests for flood control benefits, indicated under their letter referred to as Exhibit 19, page 8, in the last paragraph state "Navigation benefits resulting from any one of the three plans are, for all practical purposes a constant, and as such become a wash item."

[fol. 3580] I could have included in my economic analysis an item for that which they would have furnished, but it is relatively small. Actually, it would have no relative bearing on the comparative studies insofar as these two plans are concerned.

Q. What about recreation?

A. Recreation. I have no dollar figures, but we are quite aware of recreation with respect to operational conditions.

Q. Recreation does not appear in the B/C ratios?

A. That is correct. We are aware that there are some requirements no doubt that will be required, and we also know that many of these projects are fairly compatible with the requirements of such.

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[fol. 3585] Q. I believe you testified that there are a number of storage reservoirs above the High Mountain Sheep site on the Snake.

A. Yes. I don't know how many there are in the Snake River Valley, but I think it is not incorrect to say there are a great number and a great number of reservoirs have reflective storage quantities in the neighborhood of seven or eight million acre-feet of storage.

Many of these are irrigation reservoirs, and of course in irrigation on that river—they take the water off in the spring and summer, and the river is actually recharged during the wintertime.

The major reservoirs I can think of up there, of course, are the American Falls Reservoir, the Palisades Reservoir, which was just completed by the U.S.B.R., and of course the major reservoirs on the Boise River system. But there are many others.

Q. Has the filling of those reservoirs been taken into account then, when you formed this rule curve?

A. They have.

[fol. 3586] Q. In what sequence are the storage reservoirs other than those for the irrigation drawn out in the river system?

A. Most all those reservoirs that I have just mentioned are irrigation reservoirs, except for possibly the Lucky Peak Reservoir on the Boise River, which is a Corps of Engineers flood control reservoir at the moment.

They operate for irrigation first, and we assume in the flows, the modified flows that become available to this particular stretch of river, to take whatever is provided.

There have been very extensive studies done by the USBR in establishing what these flows should be on this stretch of the river as modified by these irrigation works today, and also what the future may hold.

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[fol. 3587] Q. At page 286, line 21, you speak of a flood control plan. What document or where in the exhibits is that control plan that you are speaking of there found?

Mr. Hugh Smith: What is the reference, Mr. Sander?

Mr. Sander: Page 286, line 21. In other words, the [fol. 3588] statement there is "Flood control has been made in accordance with the Corps of Engineers' system flood control plan."

The Witness: What I have in mind there, I think, is that the Corps of Engineers over the many, many years have what they call a major water plan in which flood control is one of the objectives. The plan I have specifically in mind is what they formulated in their recent report, Division Engineer's Report in 1958.

In addition, they have prescribed in the Brownlee license provisions a certain type of flood control operation. So, with the knowledge of what they have in mind for operating the Brownlee project, and also what they have in mind for operating the High Mountain Sheep project, we have recognized that in our multi-purpose operations in our power system studies.

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[fol. 3619] Cross examination (Resumed).

By Mr. Sander:

Q. Mr. Alspaugh, yesterday you gave us your reply as to how you handled the reservoir operation in connection with High Mountain Sheep being on a stream relatively regulated as compared to the Salmon River, which is not,

and also gave us your testimony as to how you would propose to operate the reservoir at Lower Canyon.

Will you tell us how you would propose to operate the reservoir at Nez Perce, given the same two river conditions —namely, in the Salmon and the Snake?

A. Would I assume that we are speaking of exhibits—

Q. We are using the same river conditions that you assumed or testified to in connection with operation of Lower Canyon and High Mountain Sheep.

A. If I recall correctly, I think those questions were asked with respect to WPPSS Exhibits 97 and 98.

[fol. 3620] Q. No, this was in connection with a question I asked you about the storage reservoirs up on the Snake River and how that would affect the drawdown at High Mountain Sheep. Then I asked you about reservoirs on the Salmon River and how the absence of them would affect the drawdown at Lower Canyon.

A. I believe you are correct. I think I recall now. I answered that question, as I remember, with respect to the Lower Canyon project as not having storage above it, and therefore, as I remember, I indicated that we would probably start storage withdrawal late September or October and draft, and the reservoir would be, wherever it would be, by and large in January.

With respect to answering your question on Nez Perce, we also would draft the Nez Perce project, the overlap out readily quick, and continue it on down. The over-all storage on the Nez Perce project would be slightly less than the over-all storage withdrawal from the combination Mountain Sheep and Lower Canyon by January 1, and the operation thereafter would also be on a forecast basis.

With the runoff forecasts for both streams involved, it would mean that the Nez Perce storage draft would continue on down and in general would be somewhat less than the total for the other two.

What I am thinking of in particular, I think the 1975 [fol. 3621] study would indicate that by the first of March,

I believe, the High Mountain Sheep plan had withdrawn by and large about 62,500 cfs months by the first of March.

On the other hand, in the Nez Perce project, we had withdrawn 60,000 cfs months by the first of March—assuming there is adequate run-in to permit you to do that.

There were some years, however, that we drew somewhat less, as low as 50,000 cfs months, if I remember correctly, in both plans.

So the Nez Perce project, then, is drawn not as deep as Lower Canyon, but it is drawn deeper than Mountain Sheep. It works in between.

I might say that that perhaps is somewhat indicated by the fact that, if I remember correctly, our normal use of storage required 40 percent drawdown with respect to Nez Perce, and 50 percent drawdown with respect to Lower Canyon, and about 30 percent, I believe, for High Mountain Sheep.

Q. How will this affect the design head. Compare the effect on the design head of Nez Perce and Lower Canyon.

A. This would affect the design heads to this extent, that I would find from my power routing studies that the weighted head for the High Mountain Sheep project, as I think I have indicated before, is relatively high; that is, the reservoir.

Lower Canyon, on the other hand, is relatively low, and [fol. 3622] Nez Perce falls in between, somewhat in relationship to the use of storage that I have employed.

Presiding Examiner: May I ask a question? When you speak of Nez Perce, are you talking about your Nez Perce plan?

The Witness: I have, I believe, been talking about the Nez Perce plan of PNP that is shown in my Exhibit 18 and the economic results in Exhibit 19. In all cases, Nez Perce has meant PNP Nez Perce. The major change is the China Gardens pool level effect upon the plan itself.

By Mr. Sander:

Q. I think you have touched on this, but I would like to clarify it. How would you draw Nez Perce down in relation to the overlap at Hells Canyon?

A. The overlap storage there, as in all overlap storage throughout the Northwest, is always the first storage that is drafted. In other words, this assumes that the area goes on what we call control, when any storage has to be used. Overlap storage is immediately used before any other storage; in fact, I think it is almost invariably used.

Therefore, in my opinion, assuming the storage control period to commence September 15, I think it is safe to say that all the overlap storage at Nez Perce would by and large be drawn out by November 1.

This all depends on drawing it out, drawing the overlap storage out at other reservoirs, and of course the other [fol. 3623] factor here that I do have to caution on, in order to get the Hungry Horse storage out during the seven months with its limited installation, it has to start down relatively early in the year. Of course, that does cause some delay on the use of overlap storage in the Snake River.

But there is no power lost basically when you pull out overlap storage. You might just as well pull it out early and get your energy from it, because the head that you lose at Nez Perce is made up at Hells Canyon.

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[fol. 3628] Q. I don't know whether you in fact have answered this question or not. I am checking back through. If you have, say so.

What is the basis for the installation proposed at High Mountain Sheep of five 175,000 kilowatt units?

A. I think I answered that in my direct with respect to the considerations that went into putting in the five units and the 175,000 kilowatts per unit. That is what you referred to, as I recall.

That is a function of designing a turbine for the 550-foot head that we have adopted as the rated head—primarily considerations for the five units being we do not have a reregulating dam below us and we take into account the transmission problem, and as I remember, there was one other factor that slipped my mind for the moment—one other major factor.

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[fol. 3642] Redirect examination.

By Mr. Hugh Smith:

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[fol. 3672] Q. What is the significance in a power system that depends upon hydro electric generation of average prime energy?

A. It is a basic criterion in our system analysis in determining the amount of load that a system can provide. In other words, it is a basis for determining load-carrying ability of a particular system.

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[fol. 3673] Q. If you were to operate a system so as to produce maximum peaking and average energy, but without regard to the effect of that operation on prime power in an all-hydro electric system, what would be the result of that type of an operation?

Mrs. Cooper: I object as improper redirect, Mr. Examiner.

Presiding Examiner: I will permit the question.

A. You couldn't possibly carry the load that that system is capable of carrying.

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[fol. 5889] ROBERT B. GALLUP was called as a witness, and having been first duly sworn, was examined and testified as follows:

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[fol. 5902] Cross examination.

By Mr. Hugh Smith:

Q. To be sure it is clear, do I now understand what you are saying is that the difference between coordinated operation and ultimate integrated operation is that with respect to an all-hydro system under ultimate integrated operation you would obtain greater firm load-carrying ability with respect to energy, whereas on the contrary under coordinated operation you obtain greater peaking capability and greater average annual generation?

A. Yes, I think that is correct.

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[fol. 5915] Q. And it follows subject to all those qualifications that in that case in the system as a whole under ultimate integrated operation there would be greater dependable capacity than there would be under coordinated operation?

A. You have to qualify that by saying that the entire Pacific Northwest is under one ownership, meeting loads that are to be imposed only an a single entity rather than the multiplicity of entities we have now in the Northwest. If it is so qualified, that is right.

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By Mr. Hugh Smith:

Q. We have now seen while subject to some qualifications, some considerable qualification, that under ultimate in-
[fol. 5916] tegrated operation we do get more firm energy, we get more dependable capacity, which we have in effect defined as firm peaking capability, and does this mean

that under coordinated operation all that you get—that under coordinated operation you now are getting merely peaking capability that is not dependable, and average annual energy that is not firm?

A. No.

Q. Would you explain why not?

A. I cannot agree with the original statements that you made with respect to ultimate integrated operation having more dependable capacity from the start. Secondly the problem I run into is the fact in the Pacific Northwest there is a multiplicity of ownership, and until there is complete and free exchange of peaking capability between utility ownerships you must relate dependable capacity to the load to be supplied, and the load to be supplied must be the load which is supplied by the particular ownership.

Q. Isn't it a fact the type of operation we have been describing, that you have been referring to, that we have been talking about, as ultimate integrated operation, is physically in fact the type of operation being carried on in the Northwest Power Pool today?

A. No.

Q. On what basis did you make that statement?

[fol. 5917] A. On the basis that it is not being done, that such utility operates its own reservoir for its own needs. There is no contractual requirement for any utility to operate under the ultimate integrated concept. There is no requirement for any utility to exchange peaking capability with any other utility on a basis of purchase or anything of that sort.

In fact, the Bonneville Power Administration does not have a rate—Bonneville being the largest utility in the Northwest—does not have a rate that would allow a utility to purchase peaking capability as differentiated from energy.

Q. Are you stating as a fact there are no contracts at all that provide for such interchanges in the Northwest?

A. To my knowledge there are no contracts that would embody the concept which is embodied in ultimate integrated operation, which is operating all the reservoirs in the Pacific Northwest for the good of the entire Pacific Northwest.

Q. Mr. Gallup, I wasn't asking you about the existence in my initial question, about the existence of contracts. I asked you whether or not in fact this wasn't the way in which the Northwest Power Pool has been operating over the last decade?

A. And I said absolutely not.

[fol. 5918] Q. And you said there were no contracts. I repeat my question, what is the basis for your answer?

A. That it is not being operated that way at the present time and hasn't been over the past 10 years. Actually at the present time for example the Hungry Horse reservoir under the ultimate integrated operation would have been drafted quite materially during the present storage control season. As of last Tuesday, a week ago, which was the last report I had on the operation of Hungry Horse reservoir, it was completely full, and had not been drafted. The Grand Coulee reservoir hasn't been drafted in accordance with the ultimate integrated operation concept.

Q. Have you ever examined the statement of principles of the Northwest Power Pool?

A. No.

Q. Are you aware of the existence of the operating committee of the Northwest Power Pool?

A. Yes.

Q. Are you aware of its functions?

A. In a general way.

Q. Would you describe what you understand those functions to be?

Mr. Dryer: This is far beyond the scope of direct examination.

[fol. 5919] Mr. Hugh Smith: No, sir, this witness has been testifying to what he called coordinated and integrated operation.

Presiding Examiner: I will permit the question.

A. Those functions are voluntary functions to operate the Pacific Northwest projects in the manner that would get the greatest good out of them, keeping in mind the contractual relationships between utilities and the lack of contractual relationships between the utilities and further keeping in mind the prime requirement of each utility system to meet its own load.

By Mr. Hugh Smith:

Q. Isn't it correct that statement of principles contains a statement that all of the resources of the pool shall be operated to obtain the greatest maximum usable power?

Mr. Dryer: Mr. Examiner, he testified earlier he was not familiar with the statement of principles.

Mr. Hugh Smith: He said he was.

Mr. Dryer: He said he had never read the statement of principles.

Presiding Examiner: He doesn't have to answer any question if he doesn't know it. Let's proceed.

A. As I testified earlier, I am not familiar with the statement of principles of the Northwest Power Pool.

[fol. 5920] By Mr. Hugh Smith:

Q. Are you aware that the operating committee of the Northwest Power Pool prepares each year an operating program to be followed by the pool?

A. I am aware the operating committee prepares an operating program that is to serve as a guide to each member of the pool. I am also aware that the operating program is not followed, normally.

Q. By whom?

A. By the utilities that operate.

Q. All utilities?

A. I am thinking primarily of the Bonneville Power Administration at the present time, which owns a major portion of the reservoirs in the Columbia Basin.

Q. You referred a moment ago to the operation of Hungry Horse, and that under pool operation it would have been drafted substantially below the level it is presently drafted.

Were you familiar with the operation of the Hungry Horse reservoir prior to 1959?

Mr. Dryer: Mr. Gallup referred to the drafting of Hungry Horse under integrated operation, not under Northwest Power Pool.

Presiding Examiner: But he testified the operation of the Northwest Power Pool does not meet—

[fol. 5921] Mr. Dryer: I just wanted to correct the question.

A. The first portion of Mr. Smith's characterization of my testimony was incorrect.

Presiding Examiner: You may answer, correcting any assumptions in the question that you consider incorrect.

The Witness: I didn't refer to the operation of Hungry Horse reservoir under pool operation as being drawn down. I stated Hungry Horse reservoir operation under the ultimate integrated operation concept would have been drawn down this year to a lower level than it was. Under pool operation Hungry Horse reservoir has been left up to its maximum. This creates the greatest benefit for the Bonneville Power Administration, as operator of the reservoir, reduces the water available to the downstream projects at Kerr, Thompson Falls, Noxon Rapids, Cabinet Gorge, Box Canyon, and thus reduced generation of the non-federal projects.

I am familiar in general with the Hungry Horse operation during the period 1952-59.

By Mr. Hugh Smith:

Q. Was it true Hungry Horse storage was drafted substantially in accordance with the concepts of ultimate integrated operation during that period of time up until the fall of 1958?

A. I would have to look over the records to see. I [fol. 5922] seriously doubt it.

Q. Why would you doubt it, Mr. Gallup?

A. Primarily because of the fact that the operation of the reservoirs in the Pacific Northwest has consistently been for the purpose of the utilities that own those reservoirs, not for the purpose of all the utilities downstream.

Therefore, the operation of these reservoirs has consistently been to meet the objectives of the owners of the reservoirs themselves. The work we have done in determining the upstream benefits payments for operation of these reservoirs has shown that up through the period 1956. One of the big problems we have had in the operation of the Hungry Horse reservoir, and of all reservoirs owned by Bonneville Power Administration, is the fact these reservoirs, the water is not released from these reservoirs at a time when it is usable to the downstream projects.

Q. I think it is well to keep clearly separated the difference between testimony as to what has actually happened and testimony as to what contractual problems are. I put it to you that the problem on upstream benefits has been that it hasn't been possible to obtain a commitment from the Bonneville Power Administration in advance that they will release water from their reservoir?

Mr. Dryer: Is that a question? If so, I object.

[fol. 5923] Mr. Hugh Smith: It is a question.

Presiding Examiner: Your objection is sustained.

Now let's proceed.

By Mr. Hugh Smith:

Q. Mr. Gallup, is it not a fact if all of the owners, non-federal licensees and owners of projects in the Northwest

had over the last decade taken the attitude they would operate their projects along the lines that you refer to as coordinated operation, that in fact the Northwest Power Pool would have lost between 500,000 and 1 million kilowatts of dependable capacity, load-carrying ability?

[fol. 5924] Mr. Dryer: There is no basis for this in the direct testimony.

Presiding Examiner: He can answer the question.

The Witness: No, it is not a fact.

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[fol. 5925] By Mr. Hugh Smith:

Q. What was the purpose of using coordinated operation for the 1967-68 period in your analysis, Mr. Gallup?

A. We have been working in the Pacific Northwest for a number of years in an attempt to reach agreement on an operation that would allow ultimate integrated operation. Specifically, I have been involved in this since 1954 or 1955, and we have at the time of filing of this testimony we had not reached any kind of agreement or any kind of basis for agreement as to the possibility of developing [fol. 5926] coordination agreements between utilities.

I might point out that since the filing of this testimony the Canadian Storage situation has changed fundamentally. The Pacific Northwest problems with respect to the future and the utilities in the Pacific Northwest are working very hard on a coordination agreement, in an attempt to develop an agreement which would be suitable, so that ultimate integrated operation will be able to be achieved.

I might also point out that that was a reason I wasn't able to get here yesterday, I was attempting to fit in a meeting of yesterday in Seattle on this subject, when I found I had to get to here. It is going on right now. But as of the time of filing this testimony it had not reached the scope it has since reached.

Q. I gather you have changed your judgment as to the potentiality of having necessary agreements to provide

for ultimate integrated operation as of the time Nez Perce might be on the line?

A. I think there is a much greater possibility at the present time to have that occur than I thought back in September prior to the agreements between the United States and Canada with respect to the Canadian treaty.

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[fol. 5932] Q. I have a feeling we have gotten to a workable distinction and then you fall away from me. In that answer you were, as nearly as I could get it, characterizing coordinated operation as one designed to maximize dependable capacity at site. I tried to write this down.
[fol. 5933] Is that a correct characterization?

A. It is in conjunction with the coordination which I testified to with respect to coordinating with the Bonneville system, yes.

Q. Then that would be distinguished from ultimate integrated operation which would be to maximize the load-carrying ability of the region as a whole?

Is that correct? That is in terms of prime energy and dependable capacity related to it.

A. That is true if you add the further assumption when you are speaking of the region as a whole you are speaking of one utility owning all resources in the Pacific Northwest and supplying the loads of Pacific Northwest from those resources with no assumption as to the multiplicity of ownership that actually exists.

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[fol. 5984] Q. Mr. Willey testified that their several analyses were made on the assumption China Gardens was in operation. Would you explain why you made a different assumption for the purpose of your analysis?

A. I can explain my assumption. I don't understand the question as to the assumption Mr. Willey made.

Q. Will you explain why you made your assumption, then?

A. The assumption that was made in 1967-68 and the [fol. 5985] basis for that figure that you just gave me was 1967-68 figure, and I assumed at that time that for that year China Gardens would not be in operation. I have not heard of anyone that has indicated a desire to construct the China Gardens site by 1967-68, and I have heard no one indicate that this is a project which is for consideration for construction by 67-68. Therefore, my 67-68 studies were based on natural tailwater conditions without China Gardens in operation.

Q. I assume that in actual operation Nez Perce would be load factored—the energy at Nez Perce would be load factored according to the load to be supplied, would it not?

A. This would depend upon the details of our coordination agreement with Bonneville Power Administration. I can foresee because of the transmission distance of this project to the markets if we entered into a coordination agreement as I contemplate with Bonneville Power Administration there will be many times this project will operate to get out the energy so long as Bonneville Power Administration has the peaking capacity in its projects located closer to markets, and thus in order to save transmission losses this project will be operated more nearly on an even keel rather than on a peaking basis following a load shape up and down. Were this project to be operated on an iso- [fol. 5986] lated condition without regard to anybody else in the river and without regard to the coordination agreement I anticipate with Bonneville, then it would operate to follow a load shape hour by hour. I do not anticipate that will be the operation of this project.

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[fol. 5992] A. I further assumed that it would be very possible and probably desirable for the Pacific Northwest to reduce the energy losses on the Northwest Transmission System to during the period of time that there was surplus capacity closer to the load centers, to operate that surplus capacity closer to the load centers and operate its

Nez Perce project more on an energy base. Thus the necessity for obtaining peaking capacity.

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[fol. 6016] Q. In other words, in your routing studies there is no place where you have drawn storage from the reservoir because of flood control requirements?

A. That is correct.

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[fol. 6017] Q. I direct your attention to the paragraph on the third page with the small letter "a" which provides that "Minimum flow of not less than 13,000 cfs will be maintained at Lime Point, Idaho, during annual storage refill season when determined to be required by the Corps of En-[fol. 6018] gineers in the interest of navigation. Flows of up to 16,500 cfs may be required at other times when determined by the Corps of Engineers to be necessary in the interest of navigation."

And I ask you whether or not these requirements have been taken into account in any manner in the power routing studies that you have made?

A. I think the key statement with respect to that is "when determined to be required by the Corps of Engineers in the interest of navigation."

We have not used the 13,000 cfs nor the 16,500 cfs as a basic element in our routing studies. We have used a minimum flow of 10,000 cfs during the refill period as the basic element in our studies, on the assumption that prior to the time China Gardens and Asotin are in operation the navigation on this stretch of the river up to Lime Point will be reflected, so that the minimum flow will not have to be maintained to 13,000 second-feet.

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[fol. 6206] Cross examination.

By Mr. Sander:

Q. On page 680, line 23, and line 24, it goes on beyond that, you indicate studies that "we have made" indicate that in 1967-68 approximately 3 million kilowatts of surplus peaking capability will be available over the peak periods.

If there is such a surplus—let me ask you this first. In that 3 million, is the Nez Perce peaking capability included?

A. No, it is not.

Q. In that event, my next logical question is: With that surplus, then, where are you contemplating an additional large peaking capability of Nez Perce?

A. Again, the power marketing policy of the Bonneville Power Administration has in effect forced the utilities in terms of most economical power in the Pacific Northwest to develop resources which contain greater peaking capability in relation to their nominal prime energy than the load factor of the load to be supplied.

[fol. 6207] In this case the dependable capacity of the Nez Perce project under coordinated operation is computed on the basis of a 65.3 percent annual load factor. Thus, in this case I have shown the dependable capacity supplying a segment of the load in the Pacific Northwest.

The need for operating the Nez Perce project under ultimate integrated operation if such comes into being—and I think it will in the future, whether it will be 1967-68 or not is another question—the need to get the most out of the Nez Perce project requires the addition of 10 units. The need to supply the load characteristics as shown on Exhibit 46 as a basic segment of the load of the Pacific Northwest also requires the installation of ten units, as I testified, under my coordinated operation.

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[fol. 6313a]

PROCEEDINGS

Presiding Examiner: May we come to order, please?

Whereupon, ROBERT B. GALLUP was recalled as a witness, and having been previously sworn, was examined and testified further as follows:

Presiding Examiner: Mrs. Cooper?

Mrs. Cooper: Mr. Examiner, I am in receipt, as I am sure others are, of the Chairman's letter to Mr. Otis Beasley, dated January 31, concerning the Interior letter of January 23 requesting withdrawal of Mr. Goldhammer's testimony.

In view of this communication I would like to suggest the date set for the filing of motions to strike Mr. Goldhammer's testimony be suspended until we know further where we stand with respect to his testimony.

Presiding Examiner: Mr. Sander?

Mr. Sander: Well, I guess that covers anything I might have planned to say about it. I was planning to bring it up myself, and my suggestion was along the same lines.

It seems to me under the circumstances until we have word from the Department of Interior, it seems the matter of considering his testimony for motions to strike ought to be held in abeyance.

Presiding Examiner: I take it there is no objection to [fol. 6314] holding the filing of motions to strike in abeyance.

Mr. Hugh Smith: No objection on our part, Mr. Examiner.

Presiding Examiner: I do want to say for the record though that I invited the testimony by the Department of Interior in support of the position taken in their 4(e) letter because I believe such testimony should be in the record and should be subject to cross-examination. I am proceeding on the assumption that a witness in support of the position taken by the Department will be made available.

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[fol. 6315] Redirect examination (Resumed).

By Mr. Dryer:

Q. Will you supply the information Mr. Sander asked you to get yesterday?

A. Yes, Mr. Sander as I understood it asked that I make a rough estimate of the time it would take to raise the stream flow or the releases at Nez Perce from a minimum of 10,000 second feet to a maximum of 50,000 second feet without exceeding the 1.5 foot per hour maximum increase in the water surface elevation below Lime Point. I have [fol. 6316] made a rough computation on that, and in my opinion it would be between three and four hours.

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[fol. 6378] Recross examination.

By Mr. Hugh Smith:

Q. Is the term "coordinated operation" in common use in the Northwest, Mr. Gallup? Or is this your own term?

A. This is my own term as it relates to the testimony I have presented here, to describe the type of operation which I have described.

Q. Is the term "ultimate integrated operation" in com-[fol. 6379] mon use in the Northwest, or, again, is that your own term?

A. This is my own term to describe the type of operation that I have here, to differentiate between the two.

I might point out that in the Pacific Northwest there are degrees of coordination and in order to differentiate between those degrees of coordination, I used the two terms, coordinated operation for one type of operation, ultimate integrated operation for the other type of operation.

Q. And I gather the difference between them is that in ultimate integrated operation you would have to acquire or exchange peak in addition to acquiring or exchanging energy?

A. That is the basic difference between the two as far as the outside elements that must be required in order to carry load.

Q. In so far as the type of analysis is concerned the so-called ultimate integrated operation that you show on Exhibit 122 is substantially identical as a method of analysis with that used by the Corps of Engineers in the Division Engineer's report, is it not?

A. You are speaking of the 308 report?

Q. Yes.

[fol. 6380] A. That is right.

Q. Again, it is substantially identical with the method of analysis used by Mr. Alspaugh in PNPC Exhibit 18, is it not?

Mr. Dryer: I object. Beyond the scope.

Mr. Hugh Smith: I think it is merely to show areas where we agree and where we do not agree.

Presiding Examiner: I will permit the question, if the witness knows.

The Witness: May I have the question read?

(Question read.)

A. Yes, actually the water releases from the Nez Perce project were identical month by month to the water releases from the Nez Perce project that were used in the basic backup studies which I assume were used by Mr. Alspaugh in Exhibit 18. I have not checked that—did you say 18?

By Mr. Hugh Smith:

Q. Yes. Except for April and May.

A. Yes, with the exception of the April and May change, that is correct.

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[fol. 13,347]

REBUTTAL TESTIMONY ROBERT B. GALLUP

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[fol. 13,367] Q. Why didn't you use the full 4,700,000 acre-feet of storage available at the Nez Perce Project?

A. With the completion of 15½-million acre-feet of storage in Canada and the completion of 5,010,000 acrefeet of storage at Libby, the Pacific Northwest will have in excess of 33-million acre-feet of usable storage in addition to that available at the Nez Perce Project.

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[fol. 14,577]

Oral Argument of Mrs. Evelyn N. Cooper

Mrs. Cooper: I am Mrs. Cooper, representing the Washington Public Power Supply System.

Mr. Chairman and members of the Commission, for the last ten years—

Chairman Swidler: Excuse me, Mrs. Cooper, do you wish to preserve time for rebuttal?

Mrs. Cooper: I will try to save a total of 30 minutes.

For the last ten years the public groups of the Pacific Northwest have been pleading before this Commission for full development of the water resources of the Middle Snake. The issue now is the same as it has been throughout that ten-year period, i.e., whether or not those resources will be fully or partially developed.

[fol. 14,578] We submit that Washington Public Power Supply System's proposed Nez Perce project alone will achieve the full development objective of the Federal Power Act. The Pacific Northwest Power Company's proposed High Mountain Sheep will not. The Nez Perce project would serve broad public interests in the Pacific Northwest, invigorating the sluggish economy of the region by providing the first new large block of low-cost power for industrial development that has been available in the area for a decade. It would

also make low cost power normally available for normal utility growth. It would create a spectacular recreational area in an isolated country and add to the regional income for tourism, one of the major industries of the region. It would provide control of the flood waters of the Salmon as well as the Snake, control needed for protection of downstream communities, industries, and farms.

Also Nez Perce, constructed by Washington Public Power Supply System, would have the economics of scale, would be fully integrated with other systems in the Pacific Northwest, especially the Federal System, and fully interconnected with that system, with consequent economies. Hence, it would be not just a source of the lowest cost power available, but the most efficient source of power.

These purposes are not only consonant with the objectives of the Federal Power Act, but also with such public interest objectives as the Secretary of the Interior seeks [fol. 14,579] to accomplish. These are advantages Pacific Northwest Power Company cannot claim for its proposed High Mountain Sheep project, either.

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[fol. 14,584] The mutuality of interest between Bonneville, the wholesale supplier for the Northwest, and particularly the public agencies, and WPPSS' participants points inevitably in the direction of an agreement of the sort already entered into with respect to Hanford, under which Bonneville schedules the operation of the plant and markets the entire output of the plant.

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[fol. 14,585] Chairman Swidler: You are saying in effect [fol. 14,586] one of your pluses is that you can better integrate with Bonneville than the PNPC?

Mrs. Cooper: I think the record clearly demonstrates that. Certainly we have taken on this record steps pointing in that direction more aggressively, and have gone further than PNPC.

With respect to transmission, while the transmission plans associated with these respective plants are not a matter for licensing at this time, it is significant, I think, to note that we have proposed to integrate completely with Bonneville's transmission grid even to the extent of being willing to have Bonneville build the transmission lines over which the power would be wheeled at the wheeling cost to us and in the alternative should Bonneville not be appropriated funds for that purpose we would be willing to construct the transmission lines. The same lines, however, that Bonneville would consider appropriate for construction, but we would construct them only in consultation with Bonneville, and the transmission lines we proposed in the record were worked out in consultation and approval of Bonneville.

PNPC by contrast proposes a separate and duplicating transmission system from its project to the load centers of its four sponsoring companies, resulting in 856 miles of line for the transmission of power from its plant, as contrasted with 634 miles of line for the transmission of a [fol. 14,587] substantially greater load of power from Nez Perce.

Similarly, the PNPC proposed transmission facilities are designed for a minimum cost regardless of regional transmission requires, based on only 230 KV standards. The one interconnection with Bonneville system that they proposed in the Mountain Sheep-Pleasant Valley case has been dropped, and on this record effective integration with the Federal Power System and PNPC's project is impossible.

With respect to marketing, again comparing the two projects, WPPSS proposes a marketing policy the same as Bonneville's, with preference for the public agencies, industry, and private power companies, in that order.

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[fol. 14,615] Commissioner Ross: Mrs. Cooper, judging from what you have said this morning, I gather that you

really are not interested in any application for a license for High Mountain Sheep, it is so inferior you feel that you are essentially putting all your cards on Nez Perce; is that right?

Mrs. Cooper: No, that is not the case, Mr. Ross. We have a motion pending to amend our Nez Perce license application so as to provide—so as to include High Mountain Sheep alternatively. I should add it is our High Mountain Sheep project which would have greater power output and capability.

Commissioner Ross; That would be a single project?

Mrs. Cooper: It would be a single project. We filed that amendment for the purpose of asserting our preference as a municipality, municipal agency, a public body, in the event that the Commission should decide, contrary to all of our contentions, that High Mountain Sheep should be licensed rather than Nez Perce. We submit the Examiner was in error in denying that motion. We submit that the motion should be granted.

But we also point out that that was a wholly precautionary move. As the Staff recognized in its brief, the filing of that motion to amend actually is tantamount to our [fol. 14,616] modifying our license so as to conform to the project the Commission finds best adapted, if it should find High Mountain Sheep best adapted prior to the issuance of the Commission license, rather than afterwards, as we would be entitled to under both Section 7(a) and Section 10(a) of the Act.

There are a number of legal points which I will not have time at this time to cover. The question of our authority to construct out of State. Under Washington State law we think that right is plain, notwithstanding Judge Kilkenny's decision. Whether or not we have authority under Washington State law—I should say if the Commission finds we do not, and we submit that the Commission is in no sense bound by Kilkenny's decision, it was not a party to that proceeding, its views or supersedure were not before

the judge, and the issue of such supersedure was before him—

Chairman Swidler: Mrs. Cooper, suppose the Commission should grant you a license. You couldn't sell your bonds or building the project as long as that decision is outstanding, could you?

Mrs. Cooper: I submit that we could, sir, because the Commission, as I said, is not bound by that decision. It has the right to make an independent determination, and even if the Commission were to find that under State law we do not have the express authority—and we submit at [fol. 14,617] best there is no more than an ambiguity—that we do not have authority to go outside the State to construct, if the Commission should invoke, indeed is bound by the Supreme Court decision in the Tacoma case, to invoke the superseding procedure. Because the license carries with it a right to construct, which is a federal right. Any ambiguity under State law does not go to WPPSS's legal rights.

Chairman Swidler: The question is, we cannot confer upon you exemption from limitations of State law. But can the Federal Power Commission confer that capacity upon you?

Mrs. Cooper: What I am saying is that the capacity to go outside the State to construct is inherent in an FPC license. It is a federal right to construct on a federal navigable stream, and it is not a right that can be conferred or denied by a State law. Therefore, we feel that a Commission decision on this point—that there should be no problem confronting the Commission on this point, and certainly no problem if granted a license with respect to marketing of bonds.

I might add, there has been a recent development in that Oregon case that is of some interest. Judge Kilkenny issued an order just last week, denying our motion for reconsideration, but saying that the effect in status of the WPPSS contracts with its participants, its options, par-

ticularly, was for decision by the Commission; in other [fol. 14,618] words, leaving a great deal of confusion as to just what the meaning of his earlier opinion is, in fact.

Chairman Swidler: You are not suggesting that this litigation for declaratory judgment is a vain thing, that there was no point to having brought it in the first place, are you?

Mrs. Cooper: Mr. Chairman, we instituted that litigation, and did so for the purpose of getting the question as to whether or not a certain law, or certain laws of Oregon and Idaho, which PNPC and the State Public Utilities Commission, contend we cannot in any circumstance comply with—whether or not these laws would be binding on WPPSS as an FPC licensee. And in the course of that litigation this additional question as to the power of WPPSS to construct out of the State was raised. We did not raise that question when we instituted the litigation. It was raised during the course of litigation.

Chairman Swidler: You are suggesting that we should make, must make, our own decision on the question of legal capacity?

Mrs. Cooper: Yes, sir.

Chairman Swidler: Independent of the Court, or that it is immaterial whether you have legal capacity or not?

Mrs. Cooper: No. I am saying the Commission must either find that we have authority under Washington State [fol. 14,619] law, and in that respect it can either find that we have authority under provisions that Kilkenny disregarded, or it can find that we have authority under broader provisions of that law, which Kilkenny also disregarded, or it can find that we have authority within the narrow limitation that Kilkenny adopted.

Chairman Swidler: In effect, you are saying in order that we license you we must disagree with Kilkenny on this question?

Mrs. Cooper: No, indeed. Well, if the Commission is going to license us on the ground that we have the authority under Washington State Law to construct outside the State,

that would be the case. But if the Commission were to find that we did not have clear authority under Washington State law, then they could invoke the doctrine of supersedure, and in my opinion would have no discretion but to invoke it, being bound by the Supreme Court decision in the Tacoma case.

Chairman Swidler: Tacoma and First Iowa are different. Neither says we can grant you capacities. They say we can grant you exemption from State limitations. Neither says we can grant you capacity.

Mrs. Cooper: The same issue is before the court in the Tacoma case. The Supreme Court of the State of Washington, whose decision was appealed to the Supreme Court [fol. 14,620] in that case, had drawn that distinction, and the court restored it.

We submit the distinction is invalid.

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[fol. 14,721]

Oral Argument of Donald A. Sander

Mr. Sander: My name is Donald Sander. I represent Commission Staff counsel. • • •

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[fol. 14,722] Mr. Sander: I presume you are talking about a request for a preliminary permit. And I would say he could select a stretch of river within which he wishes to hunt for a site. I do not agree with WPPSS's position that the holder of a preliminary permit must file application for the project as it is described in the application for preliminary permit. This would negative the results of studies and investigations.

The very purpose of a preliminary permit is to protect [fol. 14,723] such studies to enable the applicant to find the site, which he doesn't know until the studies are completed and may not know in fact where the best site is even when he does file.

Commissioner Ross: Then suppose a permittee finds there may be two sites like—is it The Dales, where they had to move upstream?

Mr. Sander: That is right.

Commissioner Ross: Suppose they filed an application and said they would like to introduce evidence on both sites.

Mr. Sander: I think that is proper.

Commissioner Ross: So what PNPC failed to do was when they filed, they went ahead with their application, and they didn't say anything about "In the alternative there is another possibility here"?

Mr. Sander: That may have been a procedure they could have followed. As I gathered they believed when they filed application for the Pleasant Valley-Mountain Sheep project, that they did have the most comprehensive plan. I think we have a different situation in connection with WPPSS. They have made a motion to amend their application to include an alternate project at the High Mountain Sheep site.

Commissioner Ross: Would you have granted a permit to PNPC the day they were denied a license on Pleasant [fol. 14,724] Valley-Mountain Sheep for a new permit for three years on Mountain Sheep?

Mr. Sander: No, I don't think that would be possible. We have quite a few decisions recorded where it is said the river can not be tied up more than three years under a preliminary permit, and I don't recall the decision at the present time, but I do know there are decisions where an application has been made for a second permit and it has been denied.

Commissioner Ross: But this is a different site, you know.

Mr. Sander: I agree. But it is the same stretch of the river.

Commissioner O'Connor: May I interrupt a minute? Would you point out where the Pleasant Valley-Mountain Sheep was on the chart, the original one?

Mr. Sander: The original one was 12 miles above the Mountain Sheep—

Commissioner O'Connor: The hook in the river on that chart?

Mr. Sander: Yes. The Mountain Sheep project was above the Imnaha River. The High Mountain Sheep is just below the Imnaha River.

Commissioner Ross: The project that was denied included two dams, one called Mountain Sheep and one [fol. 14,725] called Pleasant Valley?

Mr. Sander: That is correct. The limits of a preliminary permit are vague, as has been said here, and probably for a very good reason. The various explorations may show that you might find a site that is more desirable just below a particular point in a river. I think a good example was one mentioned this morning, the case of the Montana—in the case of Montana Power, where we did have a preliminary permit existing for a series of dams and a request was made or application was made for further preliminary permit, for a dam which would have been flooding out the existing projects.

In that case the Commission stated that the applicant, or the permittee, already held a permit to explore that portion of the river and he could accomplish everything necessary to be accomplished in the time given.

The only difference was this high dam would have flooded out an area further upstream.

Chairman Swidler: Your point is that a permittee can't have two bites at the cherry, once he has filed?

Mr. Sander: That is precisely and probably the shortest way of summing it up.

I have already explained Staff's position is that Staff believes PNPC did not have a priority of application when it filed the second application on March 31. It is our posi- [fol. 14,726] tion when the application for the Mountain Sheep application and the Pleasant Valley project was filed, the priority attached to that application, and when

the application for license was denied, the priority was irretrievably lost.

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[fol. 14,737] Mr. Sander: Now, I want to turn to the question of federal development under section 7(b). I disagree with the interpretation placed on it by the Department of Interior. I feel the first provisions in that section control its application. And I feel that unless in the judgment of the Commission it should be applicable they do not ever become effective.

It is further my view that when Congress used the language "whenever in the judgment of the Commission," it intended the broadest discretion possible, and also the most flexibility. Once the Commission has taken jurisdiction of an application for license, there are no facts or circumstances which require or dictate that the Commission should exercise its discretion in a particularly preconceived way. Now, if a project is proposed for licensing, and does affect a public purpose, or say it affects an existing federal development or future federal development, certainly this is something to be taken into consideration under section 7(b), no doubt. In fact, in every consideration of every license application there must be consideration to section [fol. 14,738] 7(b) and a determination of whether or not a recommendation should be made in favor of federal development. However, there is no basis that I can find for the contention that these facts that I have just listed such as a project affecting existing or future federal development —these facts do not obligate the Commission to come to any particular judgment. And certainly the Commission is not prohibited, as has been claimed under section 7(b), from issuing a license if it should be so inclined.

Mr. Ross: Why didn't Congress just say "usual recommendation federal development whenever in your discretion you so feel like it"?

Mr. Sander: Well, that is real simple. I don't know. There is more to section 7(b), of course. But I read those

provisions to mean once the Commission decides on federal development then it should do the following things.

Commissioner Ross: What was the significance, in your opinion, if any, of the amendment of 1935 which changed it from "project" to "water resources"?

Mr. Sander: I think that this is broader, it is a broader interpretation. "Water resource" certainly covers a broader area than "project," itself, and takes into consideration other public uses.

Commissioner Ross: Wasn't Congress nicely suggesting to us not to be limited when we make this finding?

[fol. 14,739] Mr. Sander: I think it would.

Mr. Ross: To look at water resources generally, and then goes on to say, "usually not approve any application for any project affecting such development." Aren't they saying there that you have to wash out that any individual project is not going to affect the broad public purpose?

Mr. Sander: That is if in the judgment of the Commission that is a project which should be for federal development.

Commissioner Ross: They are saying here we cannot approve a non-federal—

Mr. Sander: Project, if it affects development? Well, that has been done a number of times. I recall only one recommendation by the Commission to Congress for federal development, so as a matter of practice—

Commissioner Ross: That was the St. Lawrence case.

Mr. Sander: I feel that the first phrase is controlling and that if the Commission should decide that a particular project should be federally developed, then the provision states the things that should be done. I was trying to find out whether there is a line of demarcation with respect to which projects should be federally developed and which should not. I have a little on that. Possibly we can raise the question again when I get through with that.

In trying to decide which way to recommend in this case [fol. 14,740] Staff first was impressed by the fact that the

continued existence of the Federal Power Act and the existence of legislation providing for federal development indicates judgment by Congress that there are projects which should be developed federally and there are those that should be developed by private or public utilities under a license.

In trying to find out whether there was a pattern or something we could go by I looked at legislation, some of the acts which authorized federal development, and I found it hard to find any particular line or demarcation except as follows: I noticed in looking at the Tennessee Valley Act, the Bonneville Act, Flood Control Act of 1938—I find in these authorizations, navigation, flood control, and irrigation were involved, and that power was involved only incidentally. For example, in the Flood Control Act it is provided that pen stocks for future hydro-electric development are to be installed upon the recommendation of the chief of engineers and the Federal Power Commission. There was one instance where we had a large project that was primarily power, which was the Niagara project. In this case Congress did direct the Federal Power Commission to issue a license to the New York Power Authority. It might be easy to say from that if a project is primarily for flood control, irrigation, or navigation, that it should be federally developed, and if primarily for power it should be developed by a license under the Federal Power Com-
[fol. 14,741] mission. But that would overlook one very important fact, and that is the probability that there may not have been an application for this particular project at the time it was developed. It overlooks the possibility maybe if this project were going to be developed at all it had to be federally developed.

Commissioner Ross: In this case how important really in terms of the overall project, how important is navigation?

Mr. Sander: Navigation is a very, very minor matter, as I understand it.

Commissioner Ross: How important is storage, where the Canadian storage comes in?

Mr. Sander: Well, I don't believe that would affect navigation. But it would affect flood control materially.

Commissioner Ross: Would you say this project could be characterized as primarily a flood control project?

Mr. Sander: No. I would say this project is primarily for power.

Commissioner Ross: Not only at site but downstream, as well?

Mr. Sander: I would go along with that, yes. Flood control, if I recall correctly, it is presently valued before Canadian storage at around one dollar and some cents per foot, after Canadian storage it drops to around 11 cents [fol. 14,742] per foot. Yes, Staff considers this a project primarily for power.

I was going to make one other point. Even though there has been authorization for federal development there have been occurrences when an applicant has shown up, a suitable applicant, and the Federal authorization has been suspended in favor of development by a public or private utility. Public Law of the 79th Congress, Public Law 647, modified the Arkansas River Basin authorization to permit construction of the Martin Ferry project by the Grand River Dam Authority. The same occurred in Public Law 476 of the 83d Congress, modifying or suspending the Alabama Cooja River application to permit development by a licensee.

And more significant to this case is Public Law 944 of the 83d Congress which authorized the development of the Priest Rapids site for development by Grant County PUD. From this it would appear that—

Commissioner Ross: Did the Federal Power Commission make a recommendation to Congress that that should be federally developed?

Mr. Sander: Not to my knowledge.

Commissioner Ross: In other words, it may have been a political game? Had the Government been able to go to

Congress and say the Commission thinks this should be a federally developed project, you can't guess what the an-
[fol. 14,743] swer would have been?

Mr. Sander: No, I cannot. I make the point that the mere fact federal development has been authorized doesn't mean Congress has been thoroughly convinced that this water resource should be developed only by federal funds. I think these two cases illustrate that very well.

Commissioner Ross: Have you given any thought—when you are thinking in terms of recommending to Congress federal development, have you limited yourself to making a recommendation for the development of High Mountain Sheep? Or have you thought at all about the possibility of recommendation Nez Perce as a federal development?

Mr. Sander: Oh, certainly.

Commissioner Ross: So when you are talking about either—you are talking about either or both projects?

Mr. Sander: Either project. Either project in my mind is primarily a power project.

Commissioner Ross: What paid off in TVA, what got TVA started?

Mr. Sander: I am not too acquainted with TVA. All I can do is to refer to the law which started it off, and the start off, the intention of the law was to provide flood control and to provide for navigation. Although I certainly realize that power is a mighty important thing in that project, yes.

[fol. 14,744] Commissioner Morgan: If I understand you correctly, you say that we should not even acknowledge that Congress has spoken on the subject even after this authorized project on the river?

Mr. Sander: That it not what I intended, Mr. Morgan. What I intended to say, and I am answering the contention of the Department of Interior where they say because there has been federal development all down the river it is the intent of Congress that the Government should develop the river up. I am saying there is an element that hasn't been

considered here, and there are many projects that if they were developed federally, and that when an applicant did show up, public or private utility, Congress was not adverse to permitting them to develop it under license from the Federal Power Commission.

But I am not saying that this is something that influence the Commission or the submission should be controlled by that.

Commissioner Morgan: On very few occasions, over a very long period.

Mr. Sander: That is right.

Commissioner Ross: What was Grand Coulee?

Mr. Sander: I understand it was the Bureau of Reclamation, primarily for irrigation.

Commissioner Ross: And Bonneville?

[fol. 14,745] Mr. Sander: Stated to be for navigation and other purports, and the other purposes being power, of course.

Commissioner Ross: They didn't intend to use the power from these plants?

Mr. Sander: Oh, I am sure they did.

Now, just a word or two with respect to the contention of the Department of Interior. Certainly they have made a point on coordination. But I think it proceeds on the assumption it is not going to be accomplished.

Mr. Ross: Has the Idaho Power Company cooperated? In other words, is Interior's experience to date one that justifies their statement?

Mr. Sander: I have not been on that case, but I have the impression they are unhappy about it. I have the impression the Department of Interior is unhappy about it. I have not been on that case.

The position of the Department of Interior in this case seems to be to proceed on the assumption that this coordination is not going to be accomplished. I find nothing in the case to indicate that. I find nothing in the record to indicate that the public purposes to be realized from either the Nez Perce or the High Mountain Sheep project cannot be

realized or will not be provided by either of the two applicants.

And since we have here two applicants who are ready, [fol. 14,746] willing, and able to go ahead with the project, and since we have a project which is primarily for power, it seems to me entirely reasonable and consistent for Staff to recommend to the Commission that this is consistent with prior legislative action.

Commissioner Ross: Mr. Sander, let us be frank.

Mr. Sander: Certainly, Mr. Ross.

Mr. Ross: Surely, WPPSS or PNPC could be directed to cooperate.

Mr. Sander: That is right.

Mr. Ross: Under a coordination agreement now, what is going to happen? Is it going to be a compromise every time that a decision comes up relative to losing of some immediate power benefits by an applicant? Aren't they going to argue every time that you cannot do this, or you have to give us some quid pro quo, and won't we end up with a series of compromises every time there is a question comes up?

Mr. Sander: I think that is true, and I think it has gone on in the past. We have quite a few, let us say, privately developed utilities in the Columbia River Basin already. But I don't think that that is reason enough for Staff to feel that the arguments in favor of recommending a license in this case outweigh the arguments for federal development. Staff is saying while there may be arguments made for federal development, it feels that the arguments for [fol. 14,747] issuing a license in this case to either of the applicants outweigh the reasons for federal development. That is about what Staff is saying.

Chairman Swidler: You feel that most of the controversy would be about obtaining coordination or about dividing up the benefits?

Mr. Sander: Either subject is equally difficult, and it would be hard to anticipate. At this stage I would say probably both would be equally difficult, depending on the people doing the negotiation.

Commissioner Morgan: Let me ask another historical question: Has the Staff of the Federal Power Commission ever in the history of the Commission taken a position adverse to the issuance of a license and favorable to federal construction, on its own motion?

Mr. Sander: I am not sure. I can cite one case. It has been stated we have had only one case involving 7(b). But we do have another case in which the Commission did not go along with the Examiner's recommendation for 7(b), and that is found in 8 FPC page 348, the Fresno Irrigation District, and Pacific Gas & Electric Company. In that case the Presiding Examiner did recommend that—the recommendation that recommendation under 7(b) be made. The Commission didn't go along with it. It wouldn't be too hard to look up the briefs and find out what Staff did in that case.

[fol. 14,748] Commissioner Morgan: I am reasonably familiar with the behavior of the Commission, itself. I wondered if you had further information on the Staff's attitude.

Mr. Sander: Yes. I do not know of any. But I can conceive that if you had a project which involved a tremendous amount of flood control or navigation or irrigation and you had grave doubts that the applicant could finance a project of that size, I am quite sure Staff would recommend federal development.

Commissioner Morgan: Has it ever occurred to you in your experience in the Commission that there may be an ingrained bias within the Commission in favor of licensing and against federal construction?

Mr. Sander: If there is I have not felt it.

Chairman Swidler: I don't think that would be profitable to pursue.

Have you concluded?

Mr. Sander: I have concluded.

I would like to place one observation in the record, if I may. It does not bear with the issues, but I would like to say, while both applicants have pursued their particular

points of view intensely and arduously, at times they have exhibited an attitude of cooperation in exchanging of materials which cut down the cross-examination, and they have also expended considerable time at the end of the [fol. 14,749] hearing in helping to cut down briefing time by eliminating differences which are insignificant, and I think it would be less than considerate if Staff did not recognize this on the record, and thank them for it.

Thank you, gentlemen.

Chairman Swidler: We will take a five-minute recess.

(Whereupon, at 5:30 p. m., a recess was taken until 5:35 p. m. of the same day.)

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[fol. 14,756]

REBUTTAL ARGUMENT OF MRS. EVELYN N. COOPER

* * * * * * *

Mrs. Cooper: * * *

With respect to the 7(b) issue, I would like to supplement Mr. Sander's remarks with two or three observations. First, in reference to some of your comments, Mr. Ross, I wish to point out that we made application for the Nez Perce project, and as Mr. Smith has mentioned so often, pretty much at the last minute, because we had hoped that the Federal Government would undertake to build Nez Perce. But in the absence of any apparent interest on the part of the Federal Government in building Nez Perce, at least in taking the initiative in building it, we moved in with an application, rather than to sit by and see the possibility of this magnificant project go down the drain.

Furthermore, we have opposed a recommendation for [fol. 14,757] federal development under Section &(b) in this posture of things because we sincerely feel that it is politically unrealistic to assume that the Congress will ever appropriate moneys for Federal development of the Middle Snake when you have two applicants standing by ready, willing and able to provide the necessary development without Federal funds.

Finally with respect to the subject of coordination, I would like to repeat what I said this morning, that the mutuality of interest between WPPSS's participating utilities, public agencies, and Bonneville Power Administration, inevitably points towards a Hanford-type arrangement for the Middle Snake under which, as in the case of the Hanford project, Bonneville will schedule the operation of the project within the limitations of an FPC license, and market the output as well.

In these circumstances there could be no disputes about coordination insofar as the operation of the project for power purposes would have to be tailored to the requirements of the license with respect to flood control and navigation.

* * * * * * *

[fol. 14,770]

REBUTTAL ARGUMENT OF HUGH SMITH

Mr. Smith: I will not only try to be brief, I am going to have to be brief, Mr. Chairman, because of time.

Let me start with the problem of payments, what we expect. On flood control there is no difference between the way our technicians operated our dams for storage. Mr. Alspaugh in our planning operated the dam for power and flood control to the same amount. Consequently, we get the energy out for power. The maximum flood control withdrawal is determined by the maximum power withdrawal, 2,250,000 acre-feet.

Mr. Gallup for WPPSS has a different theory about what might happen, and we agree it might be right, but it didn't affect this case so we didn't go into this. But the result of his theory is that he uses less for power than for flood control. So you can draw down for flood control; under the WPPSS scheme you have water there you don't get power out of. As far as PNPC is concerned, whether we operate our way or Mr. Gallup's, we have said to you positively we will produce flood control storage from this project as re-

[fol. 14,771] quested by the Corps of Engineers, without

compensation, at any time, with or without Canadian storage at any time, without reservation, we will do it.

As far as the problem of compensation for integration, coordination, or whatever we call it, the two questions came up together, and I am sure we will be delighted with an equitable sharing of the benefits of coordination, but we have not gotten to that stage yet in the coordination agreement, and our problem at the moment is to be sure we equitably divide up the burdens of coordination so nobody gets stuck with it.

As far as our studies as to financial feasibility and economic feasibility of High Mountain Sheep are concerned, we have not assumed we would get any benefit at all downstream; that is, economic benefits. We have assumed merely that we will have access to what is called reservoir holding power, and we have included in our economic studies payments for that at the going Bonneville market rates, two and a half mills. We expect to be treated as everybody else in the area is treated under the coordination agreement, no more or less. Presently we have trouble splitting up the burdens of coordination, rather than splitting up the benefits. If we ever get to them we might see what would happen.

• • • • • • •

[fol. 14,781] Mr. Smith: Remember, the government gets 188,000 kilowatts of downstream power, under the Act, for absolutely nothing. This is a tremendous boon to the government. They add to their farm load carrying capability through our investment.

Commissioner Morgan: What do you want back for that 188?

Mr. Smith: Nothing at the moment. I just don't want to be blocked out from a coordination agreement with everybody else in the area. Coordination is not easy, it is a difficult thing. But we have solved it.

Let me say something about coordination. The way it has been mentioned today, it sounds as if it were an in-

vention of the federal government. I disagree. The power pool was first set up by "Pacific and Water Power" back in the early twenties. We expanded this pool around, Seattle and Tacoma set up an agreement between themselves for coordination. But we couldn't join it, we had an open-end pool, because the government won't come in. Their plants [fol. 14,782] were sitting there and wouldn't come in until the Office of War Utilities required them to do so, during the war. That made what we now call the Northwest Power Pool.

We went along for years under that power pool. It is not as good as it could be. We have wanted to go further, the government hasn't been willing to go further until recently. Some of us have gone further. We have the ICP agreement, which is a coordination of sorts. We have the integration agreement between Pacific Waterpower and Idaho, which was in many respects the pattern for what we now call the coordination agreement with the government.

We went ahead, finally the government went along and came in; because of the Canadian Treaty, they felt they had to do it.

I just say that we propose to coordinate this project. These four companies have too much at stake out in that area to go play footsey with a big project like this. We are going to coordinate High Mountain Sheep, even if the government won't agree with us, we will find a way to coordinate it outside.

We came in here long before the coordination agreement was signed, and testified through Mr. Robinson that we had designed this project for full coordination with the power pool, with all the storage projects in the area, we propose [fol. 14,783] to operate it that way and because we knew the benefits of coordination were so important to everybody, we were confident that that agreement that provided for coordination could be entered into.

[fol. 14,784] I might say the Supply System's expert on this said he didn't think you could enter into a coordination

agreement until around 1975 or '80, it was so difficult. Well, a year later we had a coordination agreement. It has been renewed, we are well along towards a 5-year extension, and I think presently we will have something that looks like permanent, long-range coordination.

We are prepared to commit ourselves to coordinate, we know how, we are doing it now. We will commit ourselves to the Secretary. All four of these companies are members of the coordination agreement. We couldn't keep this plant out of coordination if we wanted to. It goes in automatically; the day you issue a license we start putting this into the coordination agreement.

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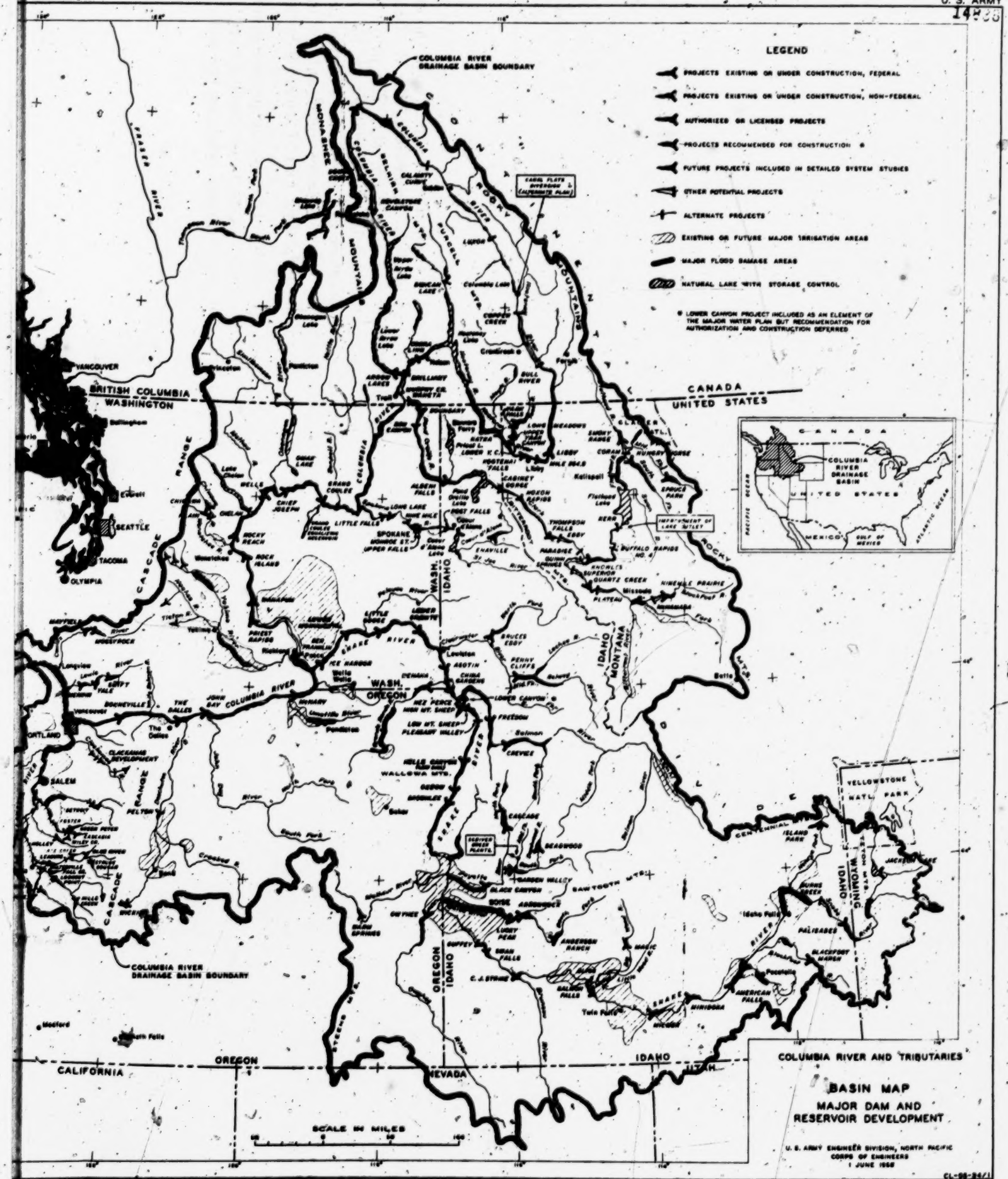
U. S. ARMY



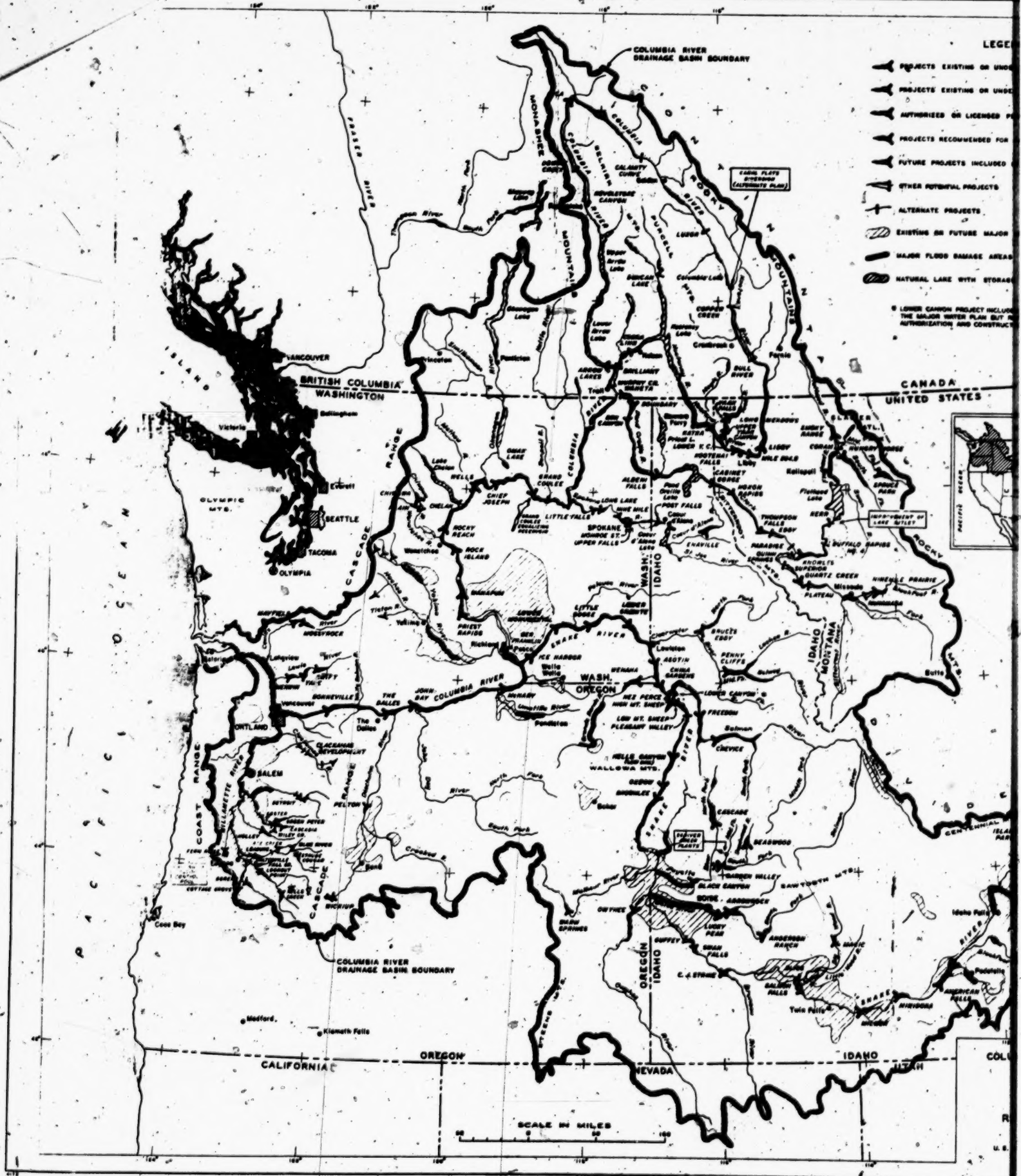

COLUMBIA RIVER AND TRIBUTARIES

# BASIN MAP
## MAJOR DAM AND RESERVOIR DEVELOPMENT

U. S. ARMY ENGINEER DIVISION, NORTH PACIFIC
CORPS OF ENGINEERS
1 JUNE 1958

CL-58-29/1

PLATE 1


COLUMBIA RIVER DRAINAGE BASIN BOUNDARY
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COLUMBIA MOUNTAINS
COAST RANGE
CASCADE RANGE
OLYMPIC MTS.
VANCOUVER ISLAND
COLUMBIA RIVER
SNAKE RIVER
FRASER RIVER
KOOTENAY RIVER
PEND OREILLE RIVER
CLARK FORK RIVER
YELLOWSTONE RIVER
GREEN RIVER
COLORADO RIVER
PUGET SOUND
GRAND COULEE
DWORSHAK RESERVOIR
HUNGRY HORSE RESERVOIR
LIBBY RESERVOIR
KOOTENAI FALLS
CABINET GORGE
ALBENI FALLS
POST FALLS
LONG LAKE
LITTLE FALLS
CHIEF JOSEPH
ROCK ISLAND
PRIEST RAPIDS
ICE HARBOR
LOWER GRANITE
LOWER MONUMENTAL
MCNARY
THE DALLES
JOHN DAY
BONNEVILLE
PORTLAND
VANCOUVER
SEATTLE
TACOMA
OLYMPIA
EVERETT
BELLINGHAM
VICTORIA
SPOKANE
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LIBERTY LAKE
CHELAN
WENATCHEE
YAKIMA
RICHLAND
PASCO
WALLA WALLA
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ASOTIN
CHINA GARDENS
PENNY CLIFFS
BRUCES EDDY
HELLS CANYON
WALLOWA MTS.
NEZ PERCE HIGH MT. SHEEP
LOW MT. SHEEP
PLEASANT VALLEY
LOWER CANYON
FREEDOM
SALMON
CHEVIS
CASCADE
DEADWOOD
BOISE
BOISE BASIN
BLACK CANYON
SWAN FALLS
OWYHEE
BRANY SPRINGS
LUCKY PEAK
ANDERSON RANCH
C. J. STRIKE
TWIN FALLS
SHOSHONE
AMERICAN FALLS
IDAHO FALLS
MILNER
SUNBURST
KOOTENAI PLATEAU
KNOWLES SUPERIOR QUARTZ CREEK
NINEMILE PRAIRIE
MISSOULA
BUTTE
HELENA
GREAT FALLS
CHIEF MTN.
CUT BANK
SWIFT CURRENT CR.
WATERTON
BELLY RIVER
ST. MARY RIVER
MILK RIVER
BULL RIVER
CROWSNEST
CRANBROOK
FERNIE
ELKO
MEDFORD
KLAMATH FALLS
COOS BAY
SCALE IN MILES

[fol. 14845]



PNPC EXHIBIT 8

COPY

DEPARTMENT OF AGRICULTURE
Washington, D. C.

March 11, 1960

Honorable Jerome K. Kuykendall
Chairman
Federal Power Commission

Dear Mr. Kuykendall:

This is in reply to your letter of October 21, 1959, addressed to the Chief, Forest Service, inviting report on the license application by the Pacific Northwest Power Company for the High Mountain Sheep Hydroelectric Project No. 2243.

The regional foresters at Portland, Oregon; Missoula, Montana; and Ogden, Utah have made an investigation of the effect of the proposed project on the protection, administration, management, and uses of the lands and resources on the Wallowa, Nezperce, and Payette National Forests. A copy of the field report is attached.

The report of the regional foresters indicates that a project of this size would have significant effects upon the management and utilization of the resources of the Wallowa, Nezperce, and Payette National Forests. The project would make significant and substantial changes in the grazing use by domestic livestock in this extensive canyon area and surrounding lands. It would cause significant loss of available winter big game habitat, and to stream fisheries.

Consideration should be given during project planning to the fact that the road system to be developed for project construction and maintenance, must, in the near future,

serve greatly accelerated public travel and national forest administration needs, as well as new use demands generated as a direct result of this project development.

It is desirable that the licensee and the Forest Service cooperate in the study and preparation of a recreational public-use plan adequate to meet the project-imposed use demands of the area. It is expected that the recreational public-use plan, and the public resource values affected by project acquisition of private lands in the area, will show need for cooperative land exchanges between the licensee and the Forest Service or the States concerned leading to a consolidation of public ownership of lands within and adjoining the project boundary.

The Forest Service is further concerned with the probability of extensive land disturbances usually associated with construction and in some instances the operation of such projects.

The following additional terms in supplement to the terms and conditions of license Form L-6 are deemed necessary for the adequate protection and utilization of the Wallowa, Nezperce, and Payette National Forests:

Sheet 2 of 14

[fol. 14846] 1. Prior to undertaking any phase of construction directly or indirectly affecting national forest lands or responsibilities, the licensee shall enter into formal agreements with the Forest Service covering specific measures for (a) fire prevention and control, (b) alleviation of damages to and assuring adequate protection of national forest lands and resources, (c) relocation and replacement of Forest Service improvements and facilities insofar as affected by the project, (d) cooperation with the Forest Service in planning, constructing, or participating in construction of any project roads, trails, and airfields or other facilities that are needed for joint use by

the licensee and Forest Service, or any roads, trails, and airfields that may serve as a part of the Forest Service permanent transportation system, and (e) sharing in the maintenance cost and betterment of national forest roads and airfields to the extent required to accommodate project use by the licensee, its contractors, subcontractors, and their employees.

2. The licensee shall, within four years from the effective date of this license, file with the Commission revised Exhibit K in accordance with the Commission's rules and regulations, showing final project boundary. The exhibit maps shall be reviewed in advance of filing with the designated representative of the Forest Service.

3. The licensee shall consult with the Forest Service in determination of the centerline location of transmission lines on or affecting national forest lands and shall secure concurrence of the Forest Service to the specific location of those lines occupying lands administered by the Forest Service.

4. The licensee shall construct, operate, and maintain such protective devices and comply with such reasonable modification in project structures and operation in the interest of fish and wildlife resources as may be prescribed hereafter by the Commission upon the recommendation of the Secretary of the Interior, the Fish and Game Departments of the States of Oregon and Idaho, and the Forest Service.

5. The road or roads constructed, owned or controlled by the licensee for project developments, shall be made available without charge to the Forest Service, its timber operators, permittees, and other users, for the orderly administration, development, and protection of the national forests involved, and for operations necessary and incident to project development, provided that such use may be limited by reasonable

safety and traffic control requirements. In appropriate circumstances and as agreed to by the Forest Service, the licensee may require payment of the user to cover a fair share of the road maintenance costs.

6. The licensee shall, prior to impounding water, clear all lands in the bottom and margins of the reservoir between a plane five feet below ultimate low water elevation (El. 1337) of the reservoir and the plane at normal pool elevation of the reservoir, and shall cut

Sheet 3 of 14

[fol. 14847] all brush and trees below the lower plane so that none protrude above Elevation 1332. The licensee shall clear and keep clear to an adequate width lands of the United States along open conduits; and shall dispose of all temporary structures, unused timber, brush, refuse, or inflammable material resulting from the clearing of the lands or from the construction and maintenance of the project works. In addition, all trees along the margin of the reservoir which may die due to operation of the reservoir shall be removed. The clearing of the lands and the disposal of the material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission.

7. The reservoir operation schedule shall be adjusted as far as possible, compatible with power generation and requirements of downstream releases, to accommodate the recreation use of the reservoir area.

Other matters of prime interest to the Forest Service such as erosion control, stream turbidity, location of quarries, borrow pits, spoil areas, and construction camps and the requirements for seeding or revegetation of disturbed areas can be accomplished through cooperative effort under the terms of the standard license conditions referred to above

and in the agreements contemplated under the recommended supplementing Article (item 1) cited above.

This Department finds that the proposed project will not interfere or be inconsistent with the purposes for which the Wallowa, Nezperce, and Payette National Forests were created or acquired providing the license contains the above conditions.

Sincerely yours,

/s/ E. L. Peterson
Assistant Secretary

Attachment

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[fol. 14848]

PNPC EXHIBIT 8
Sheet 4 of 14

COPY

## FIELD REPORT

ON AMENDED APPLICATION FOR LICENSE BY PACIFIC NORTHWEST POWER COMPANY FOR F.P.C. PROJECT NUMBER 2173/2243 HIGH MOUNTAIN SHEEP DAM

Nezperce National Forest—Region One
Wallowa National Forest—Region Six
Payette National Forest—Region Four

This report presents an analysis of the impacts of the proposed High Mountain Sheep project on forest resources, uses, facilities, services, and management within the Wallowa, Nezperce, and Payette National Forests. The figures herein presented are considered the best estimates available on the basis of the present project license application and current price levels.

The proposed project would consist of a concrete arch dam, total height 690 feet, with sidehill gated overflow spillway

section located on the Snake River in Idaho and Oregon approximately 0.5 miles upstream from the mouth of the Salmon River and 2.5 miles downstream from the mouth of the Imnaha River. It would form a reservoir with high water elevation approximately 1510 feet above mean sea level, extending 58.5 miles up the Snake River and about 10 miles up the Imnaha River. The reservoir would reach the tailwater of the Low Hells Canyon development, Project No. 1971, and would have total and maximum usable storage of 3,600,000 acre feet.

*Development of Site for Power Purposes*

In this report no attempt has been made to evaluate the feasibility, need, and justification for this project. This project has been evaluated in the report of the Division Engineer, North Pacific Division, U. S. Army Engineers, June 1958.

*Relation of Development to Rest of the Drainage and of Adjacent Areas*

The High Mountain Sheep Dam would be located on the Snake River at a point approximately one-half mile above the mouth of the Salmon River in Section 14, Township 29 North, Range 4 West, B.M., Idaho; and Section 11, Township 4 North, Range 48 West, W.M., Oregon. The dam, plus the 58.5 miles of reservoir, will cover the entire west boundary of the Nezperce National Forest and more than 60 miles of the east boundary of the Wallowa National Forest within the canyon of the Middle Snake River, and two miles of the northwest corner of the Payette Forest. At ultimate low water elevation, 1337, (as defined in the application) the upper end of the reservoir will recede approximately fourteen miles downstream to the vicinity of Saddle Creek.

In addition to flooding of the Snake River Canyon, the reservoir will inundate approximately ten miles of the

lower Imnaha River, and three miles of its tributaries, Lightning and Cow Creek.

The proposed reservoir will flood the several valley bottoms in narrow steep-walled canyons which are now used as ranch headquarters, farming for hay production, winter grazing for domestic livestock, winter game range, transportation, recreation sites, communication and trail routes. Very little commercial timber will be destroyed.

Sheet 5 of 14

[fol. 14849] It is difficult to assess the relation of the development to adjacent areas because pertinent information was not supplied with the application nor upon the maps received. It was impossible to make an adequate field study of the proposed development.

The acreage of national-forest lands to be occupied either by the project area or the reservoir surface area has not been submitted by the applicant.

*Comparison of Benefits from Other Uses of Project Area Within National-Forest Land*

Although no commercial timberland will be inundated by the reservoir, the effect of flooding will have an important impact upon the timber use of a much larger area. It is estimated one million feet of privately owned timber and eight million feet of national-forest timber will be cut during the next ten years within the zone of influence, and approximately one million feet of timber annually thereafter. This volume must be hauled over relocated sections of roads which will be inundated or made unusable as a result of project construction.

Recreation is an important use along the Snake and Lower Imnaha Rivers in this area. It is estimated that annual visitations include 2,000 fishermen on the Lower Imnaha; and 250 on the Snake River at the end of the Dug Bar Road. Approximately 500 hunters hunt the Lower Imnaha.

It is estimated 700 people made recreational trips up the Snake River by boat last year, and 500 visits were made via the Kurry Creek Road on the Idaho Side.

Mule deer and elk use the proposed reservoir site as a part of their winter range. Upland game, fur bearing animals, and waterfowl also use the area. Hunting pressure, while not heavy, is increasing each year as the area becomes more accessible.

There are fifteen ranchers operating within the reservoir area and adjacent private and national-forest land. They hold preference permits on the Wallowa National Forest for 13,100 sheep and 2,875 cattle; on the Nezperce for 5,606 sheep and 900 cattle. Most of these ranches have their headquarters and a major portion of their hay producing lands within the reservoir area.

Approximately eight miles of Forest Service roads and six miles of private roads now traverse the proposed flowage area. Three bridges (one Forest Service and two private) across the Imnaha River are within the reservoir. In addition, one Forest Service bridge across Cow Creek will be flooded. One and two tenths miles of Forest Service telephone line is located within the reservoir site. Construction of the dam and reservoir will flood a total of approximately 113 miles of national-forest trails and 28 miles of stock driveway. The stock driveway from winter grazing grounds within the Snake River Canyon to the summer ranges will be flooded where it crosses the Imnaha River near the mouth of Cow Creek, approximately seven miles below the head of the Imnaha arm of the proposed reservoir.

There are numerous patented mining claims along the Snake River and Lower Imnaha, and a few unpatented mining claims. None of the claims are being actively worked as mines at this time. Some prospecting and development work is currently being done on a few claims.

[fol. 14850] Thorn Creek Guard Station will be lost because it is within the proposed inundated area.

*Project Boundary and Area Included*

Present plans as submitted by the Company do not show lands which may be needed for project construction, operation, and maintenance. Possibly needed in connection with this project are areas for (1) construction camp sites, (2) airfields, (3) permanent project village, (4) access roads, (5) fish canal and facilities, (6) borrow areas.

A permanent project boundary should be established at the earliest possible date.

*Forest Administration and Use*

The proposed project would have a serious effect upon resource management and use. Administration, management, protection, and use will be more difficult and costly. Grazing use will decrease and recreation use will increase sharply. Fire control will be a much greater task due to the increase in use. Road and trail maintenance, recreational and general administration costs will be increased as a result of the project.

The proposed project will complicate the movement of stock to and from fall, winter, and spring ranges as well as movement within the ranges. Replacement stock driveways will entail longer and more difficult drives. Rights-of-way through privately owned lands will have to be secured.

*Effects on Access*

Access to the reservoir on the Idaho side and within the Nezperce National Forest will be via U. S. Highway No. 95 from a point two miles up the Salmon River from Whitebird, then over Forest Road No. 493. The greater portion of Road No. 493 does not meet present Forest Service

standards for lowest class permanent roads and modern day needs. It was originally constructed as a wagon road in the early days to provide access to private ranch property along the Snake River. Since additional points of access on the Idaho side are not considered feasible and no road paralleling the east shore is contemplated, either inside or outside the national forest, Road No. 493 will be all important. An estimated 10,000 visits will be made annually to the reservoir from the Idaho side within the first five years after construction. The majority of these visits will occur during the peak recreation season of May 1 to October 30. An estimated additional 20 vehicles per day will travel that portion of the road between Pittsburg Saddle and the Salmon River in connection with timber sales activity and Forest Service administrative traffic. This traffic, together with the fact that many vehicles will be pulling house and boat trailers over the route, will ultimately require a double lane road.

On the Oregon side, and within the boundaries of the Wallowa National Forest, access to the dam site, Dug Basin, and lower Imnaha tributaries will be via a road down the Imnaha River. The existing Imnaha road No. N38 is a narrow, steep, one lane road which must be relocated and reconstructed to two lane, heavy duty standard to adequately and safely serve project construction needs and use of the area by the general public.

The Dug Bar Road, No. N422, must ultimately be relocated



[fol. 14851] and improved also. At the time of this report the project access roads are not included in the project boundary. Upon application, the Forest Service will issue special use permit to the project applicant authorizing construction of the roads on national-forest lands and specifying conditions required for the adequate protection and use of those lands. It is expected this road will revert to a public agency upon completion of the project.

*Effects on Recreation Use*

The recreation workload will increase many times. The area will provide many attractions, such as boating and fishing in the impoundment, fishing in adjacent streams, hunting big game, plus sightseeing and other types of recreation in the deepest canyon on the North American Continent. The drawdown schedule should be adjusted as far as possible to accommodate recreation use. To adequately handle these anticipated needs of recreation access, a two lane road should be constructed to the vicinity of Dug Bar.

*Effects on Grazing Use and Forage Availability*

Some lands within the inundated area are presently used for winter grazing. Use of the national-forest land for winter range is coordinated and made possible with the feeding grounds and hay meadows in private ownership on the floor of the Imnaha and Snake River Canyons. There will be a reduction of the ranchers' private land grazing capacity because of the flooding of hay producing and grazing land. The effects will vary from ranch to ranch. Some will suffer a loss of grazing capacity on both private and national-forest land because of new road construction and new stock driveways, both of which will of necessity have to be located through some of the choicest grazing lands. Inundation will make necessary the realignment, and in some cases the reduction, of grazing use in parts of the Middle Snake River area. This will be a major impact when the number of animals, available forage, and home ranch displacements are considered.

It is evident some ferry service to accommodate movement of cattle, horses, and pack strings will be needed during all periods when normal routes become unusable and until replacements are completed.

*Effects on Timber Harvest*

There is little, if any, commercial timber involved within the reservoir area, either on national-forest or privately

owned land. The principal impact on timber values in the impact area will be caused by the increased length of haul due to the relocation of roads around arms of the reservoir area, with associated increased road maintenance. Until road replacement surveys are undertaken and the grade and alignment analyzed in terms of hauling cost, it is only possible to state that each mile of added haul will increase the harvesting cost of the one million board feet sustained capacity of the impact area. The average increased haul will be about five miles.

*Clearing and Cleanup*

The clearing of national-forest lands within the inundated area will not be an extensive project. Some timber and shrub growth will be encountered in the bottoms of the drainages leading into the Snake River.

Sheet 8 of 14

[fol. 14852] *Effects on the Transportation System*

It is understood the main Imnaha River Road will be reconstructed to two lane standard by the licensee. The existing road will require relocation to raise it above the flowline to obtain acceptable grade and alignment to safely meet the needs of the project, forest resource, and public use.

Dug Bar Road No. N 422 will be inundated at both ends. Portions of Cow Creek Road No. N 422A and Lightning Creek Road No. N 307 will be flooded. To restore connection with the undisturbed portion of Dug Bar and above mentioned roads, construction will be required between Imnaha River Road at the head of the reservoir and the existing Dug Bar Road north of Cow Creek. This will provide access to the roads made unusable by flooding as above mentioned. It is felt that any less than two lane will not adequately and safely handle the increased load of recreation travel together with construction imposed travel and traffic associated with normal forest resource management.

On the Idaho side, within the Nezperce National Forest, Kurry Creek Road No. 493 will ultimately be constructed to two lane standard to adequately handle project imposed recreation travel plus normal forest use.

The existing trail system will be seriously affected. Thirty-nine miles of horse and foot trails within the Nezperce will be inundated or rendered unfit for use. In addition, approximately seventy-four miles of trails on the Wallowa will be similarly affected.

Trail No. 102 extending upriver on the Idaho side from a point near Pittsburg Landing to Section 2, T. 22 N., R. 3 W., will need to be relocated and constructed. Existing length approximately 39 miles; estimated reconstructed length above flowline, 44 miles.

Trail No. 324, Imnaha Trail, nine miles flooded; to be replaced by two lane road constructed from the Imnaha to the dam site. A connection and a compacted earth unloading ramp for pack stock will be needed at Eureka Creek Trail junction.

Trail No. 339, Lower Snake River Trail, 28 miles to Somers Creek. Approximately 26 miles will be flooded and require relocation.

Trail No. 437, Upper Snake River Trail, 23 miles, will all be inundated and require relocation.

Trail No. 448, Upper Snake Way Trail, approximately five of total nine miles will be flooded and need relocation.

Trails No. 438 Saddle Creek, No. 414 Hat Point, No. 414A Hat Creek, No. 410 Four Mile, No. 403 Bear Creek Ridge, No. 440 Temperance Creek, No. 447 Salt Creek, No. 413A Pittsburg, No. 431 Pittsburg Tryon, No. 432 Somers Creek, No. 310 Cow Creek, No. 312 Cat Creek will have from one to two miles each inundated. Relocation and new connections will be necessary in each case.

Loading ramps for pack stock will be needed at the junction of Corral Creek Trail No. 309 and Tulley Creek Trail No. 336.

Billy Meadows stock driveway No. 350 crosses the permanent Imnaha Bridge just above the mouth of Cow Creek. Relocation above the flowline in suitable terrain will be necessary.

Sheet 9 of 14

[fol. 14853] The above roads, trails, and stock driveways should be relocated and constructed by the applicant to adequately restore the service provided by existing transportation facilities. Location and design must be approved by the Forest Service. All replacements must be completed not later than two years after the beginning of water impoundment. Acceptable free and unrestricted rights-of-way across private lands must be furnished the State, County, or Forest Service so that the remaining resources of the area may continue to be managed in the public interest. During the time existing transportation improvements are flooded and prior to completion of the replacement facilities the applicant shall provide for barge or ferry transportation necessary to insure adequate administration and use of the area. Barge capacity must be large enough to provide facilities for at least a nine-mule pack string or for a crew of twenty men with hand equipment needed for Forest Service administration, maintenance, and protection.

*Effects on Improvements: Replacement and Relocation*

The replacement transportation facilities will not be as satisfactory as those existing, with the exception of the two-lane road down the Imnaha to the dam site. Sections of roads and trails now on valley bottom or low benches will of necessity be located on steeper, rockier terrain resulting in more difficult alignment, steeper grades, longer routes, and higher maintenance costs—especially for the first few years after completion.

*Existing Facilities Which Will Be Lost as a Result of Project Construction:*

| *Item* | *Unit* |
|---|---|
| 1. Buildings<br>Relocation of Thorn Creek Guard Station and facilities (buildings) | 3 |
| 2. Bridges | 4 |
| 3. Roads (miles) | 30 |
| 4. Trails (including access stock trails) | 113 |
| 5. Stock Driveways (miles) | 28 |
| 6. Fences (miles) | 2 |
| 7. Telephone Lines (miles) | 2 |
| 8. Water and Sanitary Facilities | 1 |
| 9. Recreation Developments (areas) | 1 |
| 10. Other Facilities (Signs, Markers, etc.) | 15 |

*Effects on Communication*

Government owned communication facilities within the project area are limited to the telephone line to Thorn Creek Guard Station. This line must be kept in usable condition or alternate facilities provided. Project imposed need for communication facilities shall be provided by the applicant.



[fol. 14854] *Effects on Fire Control*

The fire protection load will be increased both during the construction period and during the period of greater use which will follow. The reservoir area within national-forest boundaries is classified as having an extreme rate of fire spread due to high temperatures, grass cover, and

difficult control due to poor access and steep terrain. Man-caused fires have been few in number in the past. The reservoir and improvement of access will be a major attraction and greatly increased use can be expected. Recreationists by automobile, boat, or trail will be utilizing the hazardous area.

Since the rate of spread on the grassy slopes is extreme, attack time must be held to less than one hour. If existing roads and trails are inundated prior to completion of replacement roads and trails, and periods of high fire danger (April through October) occur during this time, the licensee must provide a boat large enough to provide safe transportation for at least ten fire fighters and their equipment and with sufficient power to travel at the rate of twenty miles per hour. It is probable that hazard analysis will indicate the need for more than one facility of this type.

A fire plan must be developed annually to meet the protection requirements and to fulfill the licensee's responsibility for prevention, suppression, and possible liability for fire occurrences.

Arrangements between the applicant and the Forest Service must be made to provide suitable sites upon which fire control and administrative improvements may be constructed if Federal lands are not available or suitably located for such improvements.

*Fish & Wildlife*

The fishery agencies estimate that 51,000 adult anadromous fish migrate up the Snake River past the reservoir site.

Of this total, an estimated 16,000 spring Chinook salmon enter the Imnaha River for spawning. Whether the proposed fish handling facilities at High Mountain Sheep Dam will effectively pass adult fish upstream and young fish downstream cannot be determined at this time.

The proposed fish by-pass canal from Imnaha River to the dam site will traverse winter range of both deer and elk. Bridge type or underpass crossings at specified locations may be needed. Furthermore, sections of the canal must be fenced big-game tight or must be suitably covered wherever big game have access to the conduit to prevent game losses.

The reservoir will inundate important deer winter range on the lower slopes of Imnaha Canyon which will result in lower carrying capacity of the game range. The effects on elk range and migration routes along the slopes of Snake River Canyon are not known at this time.

Much of the remaining private lands adjacent to the shoreline should be acquired and administered to promote multiple-use in the public interest.

The U. S. Fish and Wildlife Service has not yet submitted a field report on fish and wildlife impacts.

Oregon Game and Fish Commissions are opposing the project before the State Water Resources Board.

Sheet 11 of 14

[fol. 14855] *Effects on Recreation*

*Introduction*

If license is issued for construction of the dam, a detailed on-the-ground examination of recreation development requirements will be necessary; followed by the preparation of a recreational master plan for development of the usable recreation lands.

*Physical Characteristics of Area*

The reservoir, located in a deep gorge, will have steep canyon sides except at the mouths of the creeks where small flats exist. In these small flats along the creeks there is generally an open effect with a predominance of willows

along the creek edges and a few scattered Pines. The side slopes are mostly barren. These small flats usually contain suitable space for the development of recreational facilities. Due to the inaccessible nature of the Snake River Canyon, there has been relatively little recreation use. The development of this project will, for the first time, provide easy access to the area by water for use by the recreationists in boating, fishing, hunting, camping and sight-seeing.

*Climate*

Maximum summer daytime temperatures along the Snake River may reach 120° F. Minimum temperatures do not generally fall below zero. Precipitation is about 17-26 inches per year, two to five inches of which is in the form of snow.

*Historical and Archeological Aspects*

The City of Baker, which is situated on the Old Oregon Trail, was an important freighting and stage coach center in early days. The nearby town of Halfway and old mining town of Cornucopia played an important part in the gold mining history of this area. Lewiston, Idaho, located below the proposed dam, gained importance as a transportation hub in the early days. Captain Bonneville, in visiting the Snake River Canyon in 1834, described the area as one of "wild majesty and impressive sterness". A part of Captain Bonneville's route of travel will be flooded.

When the dam construction is approved, the archeological and paleontological investigation of the reservoir site must be completed.

*Factors Influencing Recreational Development*

1. *Nature and Amount of Present Use*

   Present recreation use is limited. There are no Forest Service improved campgrounds within the project area. A navigation company maintains a mail,

freight, passenger service, and an overnight camp at the mouth of Camp Creek to serve their boat passengers. Total recreation use of the project area for 1959 was estimated to have been 4,000 persons.



[fol. 14856]

2. *Anticipated Project-Attracted Use*

Based on population trends, improvement in accessibility by the construction of roads, and the greater attraction of the project area, recreation visits are expected to increase to 200,000 the first year following completion of the project.

3. *Reservoir Drawdown During Recreation Season*

For best recreational use, drawdown must be kept to a minimum during the recreational season.

*Recommended Land Acquisition*

Due to the limited number of sites which will be available for recreational development, it will be desirable to obtain an agreement whereby the Company will exchange private land along the edge of the reservoir for other Forest Service land. This will permit the Forest Service to develop the shoreline sites needed to safeguard the public health and safety.

*Recommended Recreational Development*

Recreational development of the area will include campgrounds, picnic sites, resorts, boat docks and ramps, access roads, and a trail system which will serve the anticipated increased recreation use.

Estimated development on the Oregon side of the proposed reservoir includes sixteen campsites with a total of 110 family units, one resort with boat facilities, sixteen boat docks, and six boat ramps. Estimated development planned

on the Idaho side of the reservoir includes two campsites with a total of 48 family units, 7 picnic sites with a total of 14 family units, one special use area including a motel, store and service station with boat servicing facilities, nine boat docks, and one boat loading ramp.

*Estimated Cost and Benefits of Development*

The cost of development of estimated needed facilities to meet recreation use has been calculated, as a minimum, to be in excess of $320,000.

Annual maintenance and operation costs will exceed 5% of the basic investment.

Monetary benefits derived from this basic investment, depending upon the number and type of recreational facilities provided for public use, have been estimated at from $300,000 to over $1,000,000 annually.

*Summary of Presently Known Project Imposed Losses*

*Timber Productivity*

Timber productivity within the project area is negligible. No loss is reported for the removing of timber land from production for this project.

Sheet 13 of 14

[fol. 14857] *Forage Productivity—Annual Loss* *

*Wallowa National Forest*

70,400 animal months for sheep: = $5,900
7,000 animal months for cattle: = $4,000

*Nezperce National Forest*

35,300 animal months for sheep: = $4,700
2,400 animal months for cattle: = $1,700

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*Number of animals per allotment, rates per animal month, and seasons of use vary.

The above grazing losses are our best estimate at this time. Until such time as an acquisition program by the licensee is completed, the full impact of the development on range use cannot be determined. The management of the forage resource is based upon the carrying capacity of the public range which is in turn more or less dependent upon the amount of forage produced on the home ranches on the river flats. Since most of these basic supplementary feed production areas will be eliminated by flooding of the reservoir, the entire management plan must be reappraised after the new land ownership pattern is known. In addition, the management of stock will be rendered more difficult. The final ownership pattern may require a planned program of connecting trails through the rims to counteract this situation. These would be both expensive to construct and difficult to maintain.

Transportation costs for timber and other forest uses will be much greater as the result of the project. Until adequate surveys, designs, and other replacements plans are known, it will be difficult to accurately estimate the increased cost.

Maintenance of replacement roads and trails will be very expensive for several years after completion because of the terrain traversed.

*Soil Loss*

Soil erosion as a result of relocations, construction, increased use, and new and concentrated patterns of use cannot be properly evaluated at this time. Because of the nature of the terrain and the soils present, erosion prevention and soil stabilizing will be an important and significant part of road design and subsequent maintenance and prevention measures.

*Transmission Lines*

The present application for license contains no plan for transmission lines. It is assumed that formal application

for these facilities may be made separately and construction undertaken under a separate license, or as an amendment to the license now under consideration.

It is therefore impossible at this time to inform the Commission of the requirements for the adequate protection and utilization of the forest lands as affected by transmission lines. Such a report can be made when formal application is received for this part of the project.

Sheet 14 of 14

[fol. 14858] It is possible some lands under administration of the Forest Service may be affected by the future transmission line construction. It is expected the Commission will request review and approval of such plans by the Forest Service prior to issuance of license amendment.

*General*

The Forest Service must be the planning agency for recreation improvements and all other activities relating to land uses. If the timing of project development necessitates planning or information service expenses by the Forest Service in excess of those ordinarily incurred in meeting Government needs, the licensee will be expected to cooperate to the extent required in coordinating such services with project construction schedules.

It may become necessary in the public interest to effectuate land transfer or exchanges leading to better management and utilization of forest resources, including recreation. These needs will develop in certain areas with the commencement of project work.

It is therefore urgent that a cooperative agreement be completed at the earliest possible date, and prior to any work which directly or indirectly affects forest lands or uses in any manner, to attain a full understanding of responsibilities of both the Company and the Forest Service.

[fol. 15081]

PNPC EXHIBIT 18

# HIGH MOUNTAIN SHEEP PLAN

# AND

# NEZ PERCE PLAN

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POWER PRODUCTION STUDY

Pacific Northwest Power Company

August, 1960

TABLE 6
HIGH MOUNTAIN SHEEP PLAN POWER PRODUCTION DATA
1968 SYSTEM

| Line | Project | Usable Storage 1000 AF | 8-Mo. Avg. Prime Energy MW | 8 Mo. Max. Mo. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1937 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Kootenai Storage | 680 1/ | - | - | - | - | - | - | - |
| 2. | Hungry Horse | 2,980 | 192.3 | 309 | 97.4 | 4 | 285 | 328 | 270 |
| 3. | Flathead Lake (Kerr) | 1,215 | 136.3 | 177 | 116.7 | 3 | 172 | 185 | 178 |
| 4. | Thompson Falls | Pondage | 50.3 | 60 | 46.8 | 10 | 67 | 75 | 75 |
| 5. | Noxon Rapids | 200 | 160.2 | 192 | 197.6 | 4 | 400 | 400 | 400 |
| 6. | Cabinet Gorge | Pondage | 105.8 | 124 | 121.6 | 4 | 200 | 230 | 230 |
| 7. | Albeni Falls | 1,153 | 22.6 | 45 | 28.9 | 3 | 42.6 | 49 | 25 |
| 8. | Box Canyon | Pondage | 51.1 | 66 | 43.6 | 4 | 60 | 69 | 69 |
| 9. | Grand Coulee | 5,200 | 1,287.8 | 1,472 | 1,726.5 | 18 | 1,944 | 2,282 | 2,071 |
| 10. | Chief Joseph | Pondage | 705.0 | 787 | 951.4 | 16 | 1,024 | 1,219 | 1,219 |
| 11. | Rocky Reach | do | 432.8 | 484 | 590.2 | 7 | 711 | 775 | 775 |
| 12. | Rock Island | do | 162.7 | 176 | 177.4 | 10 | 180 | 205 | 205 |
| 13. | Wanapum | do | 358.6 | 400 | 535.5 | 10 | 750 | 900 | 900 |
| 14. | Priest Rapids | do | 348.3 | 385 | 517.9 | 10 | 785 | 870 | 870 |
| 15. | Brownlee | 1,000 | 261.9 | 326 | 280.2 | 4 | 360 | 450 | 450 |
| 16. | Oxbow | Pondage | 126.4 | 150 | 125.9 | 4 | 190 | 218 | 218 |
| 17. | Hells Canyon (Before Mt. Sheep) | do | 221.1 | 262 | 221.4 | 4 | 348 | 400 | 400 |
| 18. | Second Group plants | - 2/ | 2,070.3 | 2,333 | 2,208.8 | - | 4,400 3/ | 4,860 | 4,345 |
| 19. | Sub-Total (lines 1-18) | 12,428 | 6,693.5 | - | 7,987.8 | - | 11,918.6 | 13,515 | 12,700 |
| | HIGH MOUNTAIN SHEEP PLAN | | | | | | | | |
| 20. | High Mountain Sheep (Net) | 2,250 | 732.4 | 893 | 618.0 | 7 | 1,225 | 1,400 | 1,294 |
| 21. | Lower Canyon | 3,265 | 386.0 | 674 | 381.1 | 4 | 700 | 800 | 645 |
| 22. | China Gardens | Pondage | 208.2 | 244 | 176.3 | 3 | 255 | 300 | 300 |
| 23. | Sub-Total (lines 20-22) | 5,515 | 1,326.6 | - | 1,175.4 | - | 2,180.0 | 2,500 | 2,239 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 24. | Asotin | - | - | - | - | - | - | - | - |
| 25. | Lower Granite | - | - | - | - | - | - | - | - |
| 26. | Little Goose | - | - | - | - | - | - | - | - |
| 27. | Lower Monumental | Pondage | 261.1 | 378 | 278.4 | 4 | 360 | 414 | 414 |
| 28. | Ice Harbor | do | 261.1 | 378 | 278.4 | 4 | 360 | 414 | 414 |
| 29. | McNary | do | 528.7 | 583 | 735.1 | 14 | 980 | 1,124 | 1,124 |
| 30. | John Day | do | 791.4 | 911 | 1,067.6 | 12 | 1,304.4 | 1,500 | 1,500 |
| 31. | The Dalles | do | 643.6 | 755 | 876.4 | 14 | 1,119 | 1,283 | 1,283 |
| 32. | Bonneville | do | 465.9 | 547 | 522.3 | 10 | 518.4 | 570 | 570 |
| 33. | Sub-Total (lines 24-32) | 0 | 2,951.8 | - | 3,758.2 | - | 4,641.8 | 5,305 | 5,305 |
| 34. | Total (lines 19, 23, 33) | 17,943 | 10,971.9 | - | 12,921.4 | - | 18,740.4 | 21,320 | 20,244 |

1/ Kootenai Storage in this system operated in interest of Canadian plants
2/ Not readily available
3/ Not readily available, therefore estimated at 4400 MW

Table 6

15090

August 1, 1960

TABLE 7
NEZ PERCE PLAN POWER PRODUCTION DATA
1968 SYSTEM

| Line | Project | Usable Storage 1000 AF | 8-Mo. Avg. Prime Energy MW | 8 Mo. Max. Mo. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1937 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Kootenai Storage | 680 1/ | - | - | - | - | - | - | - |
| 2. | Hungry Horse | 2,980 | 192.3 | 309 | 97.4 | 4 | 285 | 328 | 270 |
| 3. | Flathead Lake (Kerr) | 1,215 | 136.4 | 177 | 116.7 | 3 | 172 | 185 | 178 |
| 4. | Thompson Falls | Pondage | 50.2 | 60 | 46.8 | 10 | 67 | 75 | 75 |
| 5. | Noxon Rapids | 200 | 160.2 | 192 | 197.6 | 4 | 400 | 400 | 400 |
| 6. | Cabinet Gorge | Pondage | 105.8 | 124 | 121.6 | 4 | 200 | 230 | 230 |
| 7. | Albeni Falls | 1,153 | 22.6 | 45 | 28.9 | 3 | 42.6 | 49 | 25 |
| 8. | Box Canyon | Pondage | 51.1 | 66 | 43.6 | 4 | 60 | 69 | 69 |
| 9. | Grand Coulee | 5,200 | 1,287.9 | 1,472 | 1,726.5 | 18 | 1,944 | 2,282 | 2,071 |
| 10. | Chief Joseph | Pondage | 705.0 | 787 | 951.4 | 16 | 1,024 | 1,219 | 1,219 |
| 11. | Rocky Reach | do | 432.8 | 484 | 590.2 | 7 | 711 | 775 | 775 |
| 12. | Rock Island | do | 162.7 | 176 | 177.4 | 10 | 180 | 205 | 205 |
| 13. | Wanapum | do | 358.6 | 400 | 535.5 | 10 | 750 | 900 | 900 |
| 14. | Priest Rapids | do | 348.3 | 385 | 517.9 | 10 | 785 | 870 | 870 |
| 15. | Brownlee | 1,000 | 261.9 | 326 | 280.2 | 4 | 360 | 450 | 450 |
| 16. | Oxbow | Pondage | 126.4 | 150 | 125.9 | 4 | 190 | 218 | 218 |
| 17. | Hells Canyon (Before Nez Perce) | do | 221.1 | 262 | 221.4 | 4 | 348 | 40[illegible] | 400 |
| 18. | Second Group Plants | - 2/ | 2,070.3 | 2,333 | 2,208.8 | - | 4,400 3/ | 4,860 | 4,345 |
| 19. | Sub-Total (lines 1-18) | 12,428 | 6,693.6 | - | 7,987.8 | - | 11,918.6 | 13,515 | 12,700 |
| | NEZ PERCE PLAN | | | | | | | | |
| 20. | Nez Perce (net) | 5,015 | 1,043.2 | 1,247 | 977.9 | 11 | 1,815 | 2,090 | 1,867 |
| 21. | China Gardens | Pondage | 148.5 | 177 | 130.3 | 3 | 195 | 225 | 225 |
| 22. | Sub-Total (lines 20, 21) | 5,015 | 1,191.7 | - | 1,108.2 | - | 2,010 | 2,315 | 2,092 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 23. | Asotin | - | - | - | - | - | - | - | - |
| 24. | Lower Granite | - | - | - | - | - | - | - | - |
| 25. | Little Goose | - | - | - | - | - | - | - | - |
| 26. | Lower Monumental | Pondage | 253.1 | 373 | 277.0 | 4 | 360 | 414 | 414 |
| 27. | Ice Harbor | do | 253.1 | 373 | 277.0 | 4 | 360 | 414 | 414 |
| 28. | McNary | do | 522.6 | 580 | 734.4 | 14 | 980 | 1,124 | 1,124 |
| 29. | John Day | do | 782.9 | 905 | 1,066.6 | 12 | 1,304.4 | 1,500 | 1,500 |
| 30. | The Dalles | do | 636.8 | 751 | 875.8 | 14 | 1,119 | 1,283 | 1,283 |
| 31. | Bonneville | do | 461.4 | 547 | 520.7 | 10 | 518.4 | 570 | 570 |
| 32. | Sub-Total (lines 23-31) | 0 | 2,910.1 | - | 3,751.5 | - | 4,641.8 | 5,305 | 5,305 |
| 33. | Total (lines 19, 22, & 32) | 17,443 | 10,795.4 | | 12,847.5 | | 18,570.4 | 21,135 | 20,097 |

1/ Kootenai Storage in this system operated in interest of Canadian plants.
2/ Not readily available.
3/ Not readily available, therefore estimated at 4400 MW

August 1, 1960

Table 7

[fol. 15092]

TABLE 8
HIGH MOUNTAIN SHEEP PLAN POWER PRODUCTION DATA
1975 SYSTEM

| Line | Project | Usable Storage 1000 AF | 25 Mo. Avg. Prime Energy MW | 25 Mo. Max. Mo. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Libby | 5,010 | 231.8 | 388 | 222.6 | 6 | 456 | 594 | 266 |
| 2. | Kootenai Storage | 680 1/ | - | - | - | - | - | - | - |
| 3. | Hungry Horse | 2,980 | 124.9 | 288 | 96.4 | 4 | 285 | 328 | 163 |
| 4. | Flathead Lake (Kerr) | 1,215 | 113.6 | 178 | 117.0 | 3 | 172 | 185 | 178 |
| 5. | Thompson Falls | Pondage | 45.5 | 66 | 46.9 | 10 | 67 | 75 | 75 |
| 6. | Noxon Rapids | do | 152.2 | 309 | 197.8 | 4 | 400 | 400 | 400 |
| 7. | Cabinet Gorge | do | 96.6 | 199 | 121.6 | 4 | 200 | 230 | 230 |
| 8. | Albeni Falls | 1,153 | 25.1 | 41 | 29.2 | 3 | 42.6 | 49 | 31 |
| 9. | Box Canyon | Pondage | 46.6 | 65 | 44.4 | 4 | 60 | 69 | 69 |
| 10. | Boundary | do | 316.2 | 514 | 384.2 | 6 | 540 | 621 | 621 |
| 11. | Grand Coulee | 5,200 | 1,702.6 | 2,274 | 1823.7 | 18 | 1,944 | 2,282 | 1,996 |
| 12. | Chief Joseph | Pondage | 913.1 | 1,219 | 1007.5 | 16 | 1,024 | 1,219 | 1,219 |
| 13. | Wells | do | 356.7 | 451 | 390.7 | 8 | 392 | 451 | 451 |
| 14. | Rocky Reach | do | 556.7 | 771 | 623.3 | 7 | 711 | 775 | 775 |
| 15. | Rock Island | do | 189.3 | 205 | 185.2 | 10 | 180 | 205 | 205 |
| 16. | Wanapum | do | 462.4 | 632 | 558.9 | 10 | 750 | 900 | 900 |
| 17. | Priest Rapids | do | 446.4 | 608 | 540.3 | 10 | 785 | 870 | 870 |
| 18. | Brownlee | 1,000 | 246.2 | 320 | 276.9 | 4 | 360 | 450 | 375 |
| 19. | Oxbow | Pondage | 113.3 | 155 | 125.9 | 4 | 190 | 218 | 218 |
| 20. | Hells Canyon (Before Mt. Sheep) | do | 199.0 | 271 | 221.4 | 4 | 348 | 400 | 400 |
| 21. | Bruces Eddy | 1,433 | 149.4 | 263 | 163.3 | 3 | 240 | 276 | 231 |
| 22. | Second Group Plants | - 2/ | 2,062.0 | 2,670 | 2208.8 | - | 4,400 3/ | 4,860 | 4,434 |
| 23. | Sub-Total (lines 1-22) | 18,671 | 8,549.6 | - | 9386.0 | - | 13,546.6 | 15,457 | 14,107 |
| | HIGH MOUNTAIN SHEEP PLAN | | | | | | | | |
| 24. | High Mountain Sheep (Net) | 2,250 | 610.9 | 896 | 621.8 | 7 | 1,225 | 1,400 | 1,093 |
| 25. | Lower Canyon | 3,265 | 321.2 | 707 | 378.5 | 4 | 700 | 800 | 419 |
| 26. | China Gardens | Pondage | 171.6 | 246 | 175.3 | 3 | 255 | 300 | 300 |
| 27. | Sub-Total (lines 24-26 | 5,515 | 1103.7 | - | 1175.6 | - | 2,180 | 2,500 | 1,812 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 28. | Asotin | Pondage | 197.8 | 277 | 207.4 | 3 | 288 | 331 | 331 |
| 29. | Lower Granite | do | 250.0 | 333 | 289.0 | 4 | 360 | 414 | 414 |
| 30. | Little Goose | do | 253.1 | 342 | 292.4 | 4 | 360 | 414 | 414 |
| 31. | Lower Monumental | do | 243.1 | 326 | 283.0 | 4 | 360 | 414 | 414 |
| 32. | Ice Harbor | do | 243.1 | 326 | 282.9 | 4 | 360 | 414 | 414 |
| 33. | McNary | do | 603.8 | 670 | 753.1 | 14 | 980 | 1,124 | 1,124 |
| 34. | John Day | do | 891.9 | 1,032 | 1,095.2 | 12 | 1,304.4 | 1,500 | 1,500 |
| 35. | The Dalles | do | 719.6 | 844 | 897.0 | 14 | 1,119 | 1,283 | 1,283 |
| 36. | Bonneville | do | 515.7 | 570 | 539.8 | 10 | 518.4 | 570 | 570 |
| 37. | Sub-Total (lines 28-36 | - | 3918.1 | - | 4639.8 | - | 5,649.8 | 6,464 | 6,464 |
| 38. | Total (lines 23, 27, 37) | 24,186 | 13571.4 | - | 15201.4 | - | 21,376.4 | 24,421 | 22,383 |

Table 8

1/ Kootenai storage in this system operated in interest of Canadian plants
2/ Not readily available
3/ Not readily available, therefore estimated at 4400 MW

August 1, 1960

15092

[fol. 15093]

TABLE 9
NEZ PERCE PLAN POWER PRODUCTION DATA
1975 SYSTEM

| Line | Project | Usable Storage 1000 AF | 25 No. Avg. Prime Energy MW | 25 No. Max. No. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Libby | 5,010 | 231.8 | 388 | 222.6 | 6 | 456 | 594 | 266 |
| 2. | Kootenai Storage | 680 1/ | - | - | - | - | - | - | - |
| 3. | Hungry Horse | 2,980 | 124.9 | 288 | 96.4 | 4 | 285 | 328 | 163 |
| 4. | Flathead Lake (Kerr) | 1,215 | 113.6 | 178 | 117.0 | 3 | 172 | 185 | 178 |
| 5. | Thompson Falls | Pondage | 45.5 | 66 | 46.9 | 10 | 67 | 75 | 75 |
| 6. | Noxon Rapids | do | 152.2 | 309 | 197.8 | 4 | 400 | 400 | 400 |
| 7. | Cabinet Gorge | do | 96.6 | 199 | 121.6 | 4 | 200 | 230 | 230 |
| 8. | Albeni Falls | 1,153 | 25.1 | 41 | 29.2 | 3 | 42.6 | 49 | 31 |
| 9. | Box Canyon | Pondage | 46.6 | 65 | 44.4 | 4 | 60 | 69 | 69 |
| 10. | Boundary | do | 316.2 | 514 | 384.2 | 6 | 540 | 621 | 621 |
| 11. | Grand Coulee | 5,200 | 1,702.6 | 2,274 | 1823.7 | 18 | 1,944 | 2,282 | 1,996 |
| 12. | Chief Joseph | Pondage | 913.1 | 1,219 | 1007.5 | 16 | 1,024 | 1,219 | 1,219 |
| 13. | Wells | do | 356.7 | 451 | 390.7 | 8 | 392 | 451 | 451 |
| 14. | Rocky Reach | do | 556.7 | 771 | 623.3 | 7 | 711 | 775 | 775 |
| 15. | Rock Island | do | 189.3 | 205 | 185.2 | 10 | 180 | 205 | 205 |
| 16. | Wanapum | do | 462.4 | 632 | 558.9 | 10 | 750 | 900 | 900 |
| 17. | Priest Rapids | do | 446.4 | 608 | 540.3 | 10 | 785 | 870 | 870 |
| 18. | Brownlee | 1,000 | 246.2 | 320 | 276.9 | 4 | 360 | 450 | 375 |
| 19. | Oxbow | Pondage | 113.3 | 155 | 125.9 | 4 | 190 | 218 | 218 |
| 20. | Hells Canyon (Before Nez Perce) | do | 199.0 | 271 | 221.4 | 4 | 348 | 400 | 400 |
| 21. | Bruces Eddy | 1,433 | 149.4 | 263 | 163.3 | 3 | 240 | 276 | 231 |
| 22. | Second Group Plants | 2/ | 2,062.0 | 2,670 | 2208.8 | - | 4,400 3/ | 4,860 | 4,434 |
| 23. | Sub-Total (lines 1-22) | 18,671 | 8,549.6 | - | 9386.0 | - | 13,546.6 | 15,457 | 14,107 |
| | NEZ PERCE PLAN | | | | | | | | |
| 24. | Nez Perce (Net) | 5,015 | 888.8 | 1,365 | 978.0 | 11 | 1,815 | 2,090 | 1,470 |
| 25. | China Gardens | Pondage | 125.2 | 181 | 129.7 | 3 | 195 | 225 | 225 |
| 26. | Sub-Total (lines 24,25) | 5,015 | 1,014.0 | - | 1107.7 | - | 2,010 | 2,315 | 1,695 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 27. | Asotin | Pondage | 195.2 | 276 | 207.2 | 3 | 288 | 331 | 331 |
| 28. | Lower Granite | do | 247.5 | 337 | 288.0 | 4 | 350 | 414 | 414 |
| 29. | Little Goose | do | 250.5 | 345 | 292.1 | 4 | 360 | 414 | 414 |
| 30. | Lower Monumental | do | 240.7 | 329 | 282.3 | 4 | 360 | 414 | 414 |
| 31. | Ice Harbor | do | 240.7 | 330 | 282.2 | 4 | 360 | 414 | 414 |
| 32. | McNary | do | 601.8 | 668 | 752.6 | 14 | 980 | 1,124 | 1,124 |
| 33. | John Day | do | 889.3 | 1,027 | 1094.4 | 12 | 1,304.4 | 1,500 | 1,500 |
| 34. | The Dalles | do | 717.6 | 840 | 896.5 | 14 | 1,119 | 1,283 | 1,283 |
| 35. | Bonneville | do | 514.4 | 570 | 539.2 | 10 | 518.4 | 570 | 570 |
| 36. | Sub-Total (lines 27-35) | 0 | 3,897.7 | - | 4634.5 | - | 5,649.8 | 6,464 | 6,464 |
| 37. | Total (lines 23, 26, 36) | 23,686 | 13,461.3 | - | 15,128.2 | - | 21,206.4 | 24,236 | 22,266 |

1/ Kootenai Storage in this system operated in interest of Canadian plants.
2/ Not readily available
3/ Not readily available, therefore estimated at 4400 MW

Table 9

August 1, 1960

15093

[fol. 15094]

TABLE 10
HIGH MOUNTAIN SHEEP PLAN POWER PRODUCTION DATA
1985 SYSTEM
(Corps of Engineers Sequence IV J Adjusted)

| Line | Project | Usable Storage 1000 AF | 31 Mo. Avg. Prime Energy MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|
| 1. | Hungry Horse | 2,980 | 99 | 98 | 4 | 285 | 300 | 182 |
| 2. | Flathead Lake (Kerr) | 1,217 | 118 | 121 | 3 | 180 | 180 | 173 |
| 3. | Knowles | 3,084 | 153 | 151 | 4 | 274 | 315 | 208 |
| 4. | Hinemile Prairie | 600 | 18 | 19 | 3 | 60 | 60 | 60 |
| 5. | Libby | 5,010 | 192 | 217 | 4 | 344 | 396 | 182 |
| 6. | Long Meadows | 400 | 6 | 6 | 2 | 18 | 21 | 13 |
| 7. | Kootenai Lake | 910 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. | Albeni Falls | 1,153 | 30 | 29 | 3 | 43 | 43 | 26 |
| 9. | Enaville | 700 | 21 | 26 | 2 | 60 | 69 | 44 |
| 10. | Coeur d' Alene Lake | 220 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11. | Grand Coulee | 5,072 | 1,881 | 2,018 | 24 | 2,880 | 2,880 | 2,707 |
| 12. | Brownlee | 1,034 | 165 | 218 | 4 | 360 | 360 | 214 |
| 13. | Wenaha | 900 | 60 | 73 | 2 | 134 | 154 | 149 |
| 14. | Penny Cliffs | 2,300 | 165 | 194 | 4 | 292 | 337 | 262 |
| 15. | Bruces Eddy | 1,433 | 127 | 154 | 3 | 240 | 276 | 224 |
| 16. | Quartz Creek | Pondage | 33 | 40 | 3 | 78 | 90 | 90 |
| 17. | Kootenai Falls | do | 116 | 122 | 3 | 180 | 207 | 207 |
| 18. | Thompson Falls | do | 61 | 58 | 10 | 67 | 75 | 75 |
| 19. | Noxon Rapids | do | 181 | 204 | 4 | 400 | 400 | 400 |
| 20. | Cabinet Gorge | do | 130 | 143 | 4 | 240 | 240 | 240 |
| 21. | Box Canyon | do | 55 | 56 | 4 | 69 | 69 | 69 |
| 22. | Boundary | do | 351 | 400 | 6 | 600 | 600 | 600 |
| 23. | Chief Joseph | do | 1,042 | 1,138 | 24 | 1,536 | 1,766 | 1,766 |
| 24. | Wells | do | 380 | 412 | 11 | 539 | 620 | 620 |
| 25. | Rocky Reach | do | 574 | 623 | 8 | 813 | 935 | 935 |
| 26. | Rock Island | do | 220 | 216 | 10 | 249 | 249 | 234 |
| 27. | Wanapum | do | 476 | 523 | 10 | 712 | 775 | 775 |
| 28. | Priest Rapids | do | 500 | 551 | 10 | 750 | 801 | 801 |
| 29. | Oxbow | do | 102 | 122 | 4 | 190 | 219 | 219 |
| 30. | Hells Canyon (before Mt. Sheep) | do | 170 | 205 | 4 | 348 | 400 | 400 |
| 31. | Independent Resources | 1/ | 2,101 | 2,432 | - | 5,000 2/ | 5,643 | 5,124 |
| 32. | Sub-Total (lines 1-31) | 27,013 | 9,527 | 10,569 | | 16,941 | 18,480 | 16,999 |
| | HIGH MOUNTAIN SHEEP PLAN | | | | | | | |
| 33. | High Mountain Sheep (Net) | 2,250 | 491 | 584 | 7 | 1,225 | 1,400 | 956 |
| 34. | Lower Canyon | 3,265 | 309 | 401 | 4 | 700 | 800 | 423 |
| 35. | China Gardens | Pondage | 143 | 169 | 3 | 255 | 300 | 300 |
| 36. | Sub-Total (lines 33-35) | 5,515 | 943 | 1,154 | | 2,180 | 2,500 | 1,679 |
| | DOWNSTREAM PLANTS | | | | | | | |
| 37. | Asotin | Pondage | 176 | 204 | 3 | 288 | 331 | 331 |
| 38. | Lower Granite | do | 232 | 276 | 4 | 400 | 460 | 460 |
| 39. | Little Goose | do | 242 | 279 | 4 | 360 | 414 | 414 |
| 40. | Lower Monumental | do | 222 | 264 | 4 | 360 | 414 | 414 |
| 41. | Ice Harbor | do | 230 | 272 | 4 | 360 | 414 | 414 |
| 42. | McNary | do | 653 | 754 | 14 | 980 | 1,127 | 1,127 |
| 43. | John Day | do | 962 | 1,134 | 14 | 1,522 | 1,750 | 1,750 |
| 44. | The Dalles | do | 806 | 945 | 16 | 1,248 | 1,435 | 1,435 |
| 45. | Bonneville | do | 553 | 625 | 13 | 756 | 756 | 756 |
| 46. | Sub-Total (lines 37-45 | - | 4,076 | 4,753 | | 6,274 | 7,101 | 7,101 |
| 47. | Total (lines 32, 36, 46) | 32,528 | 14,546 | 16,476 | | 25,395 | 28,081 | 25,779 |

1/ Not readily available
2/ Not readily available, therefore estimated at 5,000 MW

Table 10

August 1, 1960

15094

[fol. 15095]

# TABLE 10A

POWER REGULATION DATA
SEQUENCE IV-J-(1985)
(PNW CO. PLAN AND POWER COEFFICIENTS)
A-1

| Project | Usable Storage 1000 AF | 31-Mo. Ave. Cont. Power MW | Average Annual Energy Generation MW | Average Annual Energy Spilled MW | No. of Units | Total Nameplate Rating MW | Total Overload Rating MW | January 1932 Peaking Capability MW |
|---|---|---|---|---|---|---|---|---|
| Hungry Horse | 2,980 | 99 | 98 | 0 | 4 | 285 | 300 | 182 |
| Flathead Lake | 1,217 | 118 | 121 | 17 | 3 | 180 | 180 | 173 |
| Rhodes | 3,084 | 153 | 151 | 5 | 4 | 274 | 315 | 208 |
| Ninemile Prairie | 600 | 18 | 19 | 0 | 3 | 60 | 60 | 60 |
| Libby | 5,010 | 192 | 217 | 7 | 4 | 344 | 396 | 182 |
| Long Meadows | 400 | 6 | 6 | 0 | 2 | 18 | 21 | 13 |
| Kootenay Lake | 910 | - | - | - | - | - | - | - |
| Albeni Falls | 1,153 | 30 | 29 | 10 | 3 | 43 | 43 | 26 |
| Enaville | 700 | 21 | 26 | 2 | 2 | 60 | 69 | 44 |
| Coeur d'Alene Lake | 220 | - | - | - | - | - | - | - |
| Grand Coulee | 5,072 | 1,881 | 2,018 | 252 | 24 | 2,880 | 2,880 | 2,707 |
| Chelan | 676 | 42 | 43 | 5 | 2 | 54 | 54 | 50 |
| Brownlee | 1,034 | 164 | 218 | 10 | 4 | 360 | 360 | 214 |
| Lower Canyon | 3,265 | 325 | 413 | 41 | 4 | 700 1/ | 800 | 416 |
| High Mt. Sheep | 2,247 | 488 | 600 | 2 | 7 | 1,225 1/ | 1,400 | 938 |
| Wenaha | 900 | 60 | 73 | 7 | 2 | 134 | 154 | 149 |
| Penny Cliffs | 2,300 | 165 | 194 | 12 | 4 | 292 | 337 | 262 |
| Bruces Eddy | 1,433 | 127 | 154 | 16 | 3 | 240 | 276 | 224 |
| Quarts Creek | Pondage | 33 | 40 | 9 | 3 | 78 | 90 | 90 |
| Kootenai Falls | " | 116 | 122 | 5 | 3 | 180 | 207 | 207 |
| Thompson Falls | " | 61 | 58 | 21 | 10 | 67 | 75 | 75 |
| Noxon Rapids | " | 181 | 204 | 8 | 4 | 400 | 400 | 400 |
| Cabinet Gorge | " | 130 | 143 | 8 | 4 | 240 | 240 | 240 |
| Box Canyon | " | 55 | 56 | 14 | 4 | 69 | 69 | 69 |
| Boundary | " | 351 | 400 | 41 | 6 | 600 | 600 | 600 |
| Post Falls | " | 11 | 15 | 4 | Proposed | 25 | 25 | 25 |
| Upper Falls | " | 15 | 18 | 8 | " | 26 | 30 | 30 |
| Monroe Street | " | 18 | 21 | 9 | " | 31 | 36 | 36 |
| Ninemile | " | 19 | 24 | 7 | " | 38 | 44 | 44 |
| Long Lake | " | 53 | 71 | 11 | " | 130 | 150 | 150 |
| Little Falls | " | 23 | 31 | 5 | " | 57 | 66 | 66 |
| Chief Joseph | " | 1,042 | 1,138 | 106 | 24 | 1,536 | 1,766 | 1,766 |
| Wells | " | 380 | 412 | 34 | 11 | 539 | 620 | 620 |
| Rocky Reach | " | 574 | 623 | 64 | 8 | 813 | 935 | 935 |
| Rock Island | " | 220 | 216 | 44 | 10 | 249 | 249 | 234 |
| Wanapum | " | 476 | 523 | 47 | 10 | 712 | 775 | 775 |
| Priest Rapids | " | 504 | 551 | 49 | 10 | 750 | 801 | 801 |
| Oxbow | " | 107 | 122 | 4 | 4 | 190 | 219 | 219 |
| Hells Canyon | " | 167 | 194 | 3 | 4 | 400 1/ | 400 | 400 |
| China Gardens | " | 147 | 171 | 4 | 3 | 259 1/ | 300 | 300 |
| Asotin | " | 176 | 201 | 11 | 3 | 288 | 331 | 331 |
| Lower Granite | " | 232 | 273 | 15 | 4 | 400 | 460 | 460 |
| Little Goose | " | 242 | 276 | 27 | 4 | 360 | 414 | 414 |
| Lower Monumental | " | 222 | 262 | 19 | 4 | 360 | 414 | 414 |
| Ice Harbor | " | 230 | 269 | 27 | 4 | 360 | 414 | 414 |
| McNary | " | 653 | 752 | 60 | 14 | 980 | 1,127 | 1,127 |
| John Day | " | 962 | 1,131 | 75 | 14 | 1,522 | 1,750 | 1,750 |
| The Dalles | " | 806 | 943 | 63 | 16 | 1,248 | 1,435 | 1,435 |
| Bonneville | " | 553 | 624 | 60 | 12 | 756 | 756 | 756 |
| Gross At Site | 33,701 | 12,639 | 14,266 | 1,243 | - | 20,806 | 22,843 | 21,031 |
| Transmission Loss | | - 442 | - 499 | - | - | - | - | - 946 |
| Net At Load Center | | 12,197 | 13,767 | - | - | - | - | 20,085 |

1/ Overload used in power regulation for energy.

*Corps of Engineers Tabulation

NPDGH
June 1968

Table 10A

15095

[fol. 15096]

## TABLE 10B

### ADJUSTMENTS MADE IN CORPS OF ENGINEERS SEQUENCE IV J (SYSTEM A-1, TABLE 10A) TO OBTAIN PNPC DATA GIVEN IN TABLE 10

1. China Gardens tailwater changed from Elev. 842.5 to Elev. 845 as stipulated in the Washington Prehearing Conference, Transcript Vol. 1, Page 5.

2. Pool level of 940 used at China Gardens which is same as the Corps used in the A-1 System but adjusted to PNPC H/K and capability factors and without deducting 200 cfs as assumed in the Corps routing. This is in accordance with Item 1 (d) Engineering Items of Agreement, San Francisco, July 11 and 12, 1960.

3. Used 1985 flows as stipulated in Prehearing Exhibits 19 and 22 for both High Mountain Sheep and Lower Canyon Projects, the same as was done in the Corps of Engineers Study System A-1.

4. Used PNPC H/K and capability data in lieu of Corps interpretation of PNPC data (the Corps used PNPC data but did not recognize penstock losses.)

5. Adjusted the Corps routing of High Mountain Sheep and Lower Canyon storage, which affected the output of these plants without altering the combined storage use nor the downstream output during the critical storage period. Adjusted the use of storage during the non-critical storage period based on run-off forecasts which decreased the spill at the Plan and downstream projects, thereby increasing total generation. Always drafted High Mountain Sheep overlap storage prior to use of Lower Canyon storage which the Corps was not always consistent in doing in their routing study.

6. Changed the average generation for Brownlee to 165 MW from 164 MW as given in the Corps Summary on Table 10A to be comparable inasmuch as Brownlee production in both the Corps routings are the same throughout the 240 months to the exact megawatt month.

7. Netted out High Mountain Sheep Project and returned to the Hells Canyon Project loss of power due to overlap storage.

8. Independent Resources Data shown on line 31 of Table 10, are taken from Prehearing Exhibits 12 and 13 and, in addition, include the Chelan plant and the Spokane River plants data contained in Table 10A.



August 1, 1960

TABLE 11
NEZ PERCE PLAN POWER PRODUCTION DATA
1985 SYSTEM
(Corps of Engineers - Sequence IV H Adjusted)

| Line | Project | Usable Storage 1000 AF | 31 No. Avg. Prime Energy MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|
| 1. | Hungry Horse | 2,980 | 99 | 98 | 4 | 285 | 300 | 182 |
| 2. | Flathead Lake (Kerr) | 1,217 | 118 | 121 | 3 | 180 | 180 | 173 |
| 3. | Knowles | 3,084 | 153 | 151 | 4 | 274 | 315 | 208 |
| 4. | Nine Mile Prairie | 600 | 18 | 19 | 3 | 60 | 60 | 60 |
| 5. | Libby | 5,010 | 192 | 217 | 4 | 344 | 396 | 182 |
| 6. | Long Meadows | 490 | 6 | 6 | 2 | 18 | 21 | 13 |
| 7. | Kootenai Lake | 910 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. | Albeni Falls | 1,153 | 30 | 29 | 3 | 43 | 43 | 26 |
| 9. | Enaville | 700 | 21 | 26 | 2 | 60 | 69 | 44 |
| 10. | Coeur d' Alene Lake | 220 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11. | Grand Coulee | 5,072 | 1,881 | 2,018 | 24 | 2,880 | 2,880 | 2,707 |
| 12. | Brownlee | 1,034 | 165 | 218 | 4 | 360 | 360 | 214 |
| 13. | Wenaha | 900 | 60 | 73 | 2 | 134 | 154 | 149 |
| 14. | Penny Cliffs | 2,300 | 165 | 194 | 4 | 292 | 337 | 262 |
| 15. | Bruces Eddy | 1,433 | 127 | 154 | 3 | 240 | 276 | 224 |
| 16. | Quartz Creek | Pondage | 33 | 40 | 3 | 78 | 90 | 90 |
| 17. | Kootenai Falls | do | 116 | 122 | 3 | 180 | 207 | 207 |
| 18. | Thompson Falls | do | 61 | 56 | 10 | 67 | 75 | 75 |
| 19. | Noxon Rapids | do | 181 | 204 | 4 | 400 | 400 | 400 |
| 20. | Cabinet Gorge | do | 130 | 143 | 4 | 240 | 240 | 240 |
| 21. | Box Canyon | do | 55 | 56 | 4 | 66 | 69 | 69 |
| 22. | Boundary | do | 351 | 400 | 6 | 600 | 600 | 600 |
| 23. | Chief Joseph | do | 1,042 | 1,138 | 24 | 1,536 | 1,766 | 1,766 |
| 24. | Wells | do | 389 | 412 | 11 | 539 | 620 | 620 |
| 25. | Rocky Reach | do | 574 | 623 | 8 | 813 | 935 | 935 |
| 26. | Rock Island | do | 220 | 216 | 10 | 249 | 249 | 234 |
| 27. | Wanapum | do | 476 | 523 | 10 | 712 | 775 | 775 |
| 28. | Priest Rapids | do | 500 | 551 | 10 | 750 | 801 | 801 |
| 29. | Oxbow | do | 102 | 122 | 4 | 190 | 219 | 219 |
| 30. | Hells Canyon (before Nez Perce) | do | 170 | 205 | 4 | 346 | 400 | 400 |
| 31. | Independent Resources | - 1/ | 2,101 | 2,432 | | 5,000 2/ | 5,643 | 5,124 |
| 32. | Sub-Total (lines 1-31) | 27,013 | 9,527 | 10,569 | | 16,941 | 18,480 | 16,999 |
| | NEZ PERCE PLAN | | | | | | | |
| 33. | Nez Perce (Net) | 5,015 | 770 | 969 | 11 | 1,815 | 2,090 | 1,315 |
| 34. | China Gardens | Pondage | 105 | 125 | 3 | 195 | 225 | 225 |
| 35. | Sub-Total (lines 32-34) | 5,015 | 875 | 1,094 | | 2,010 | 2,315 | 1,540 |
| | DOWNSTREAM PLANTS | | | | | | | |
| 36. | Asotin | Pondage | 174 | 204 | 3 | 286 | 331 | 331 |
| 37. | Lower Granite | do | 230 | 276 | 4 | 400 | 460 | 460 |
| 38. | Little Goose | do | 240 | 279 | 4 | 360 | 414 | 414 |
| 39. | Lower Monumental | do | 220 | 264 | 4 | 360 | 414 | 414 |
| 40. | Ice Harbor | do | 228 | 270 | 4 | 360 | 414 | 414 |
| 41. | McNary | do | 651 | 754 | 14 | 980 | 1,127 | 1,127 |
| 42. | John Day | do | 960 | 1,133 | 14 | 1,522 | 1,750 | 1,750 |
| 43. | The Dalles | do | 804 | 944 | 16 | 1,248 | 1,435 | 1,435 |
| 44. | Bonneville | do | 552 | 625 | 13 | 756 | 756 | 756 |
| 45. | Sub-Total (lines 36-44) | - | 4,059 | 4,749 | | 6,274 | 7,101 | 7,101 |
| 46. | Total (lines 32, 35, 45) | 32,028 | 14,461 | 16,412 | | 25,225 | 27,896 | 25,640 |

1/ Not readily available
2/ Not readily available, therefore estimated at 5000 MW

Table 11

August 1, 1960

[fol. 15098]

# TABLE 11A

POWER REGULATION DATA
SEQUENCE IV-H-1985
(U. S. PLAN AND POWER COEFFICIENTS)
B-1

| Project | Usable Storage 1000 AF | 31-No. Ave. Cont. Power Mw | Average Annual Energy Generation Mw | Average Annual Energy Spilled Mw | No. of Units | Total Nameplate Rating Mw | Total Overload Rating Mw | January 1932 Peaking Capability Mw |
|---|---|---|---|---|---|---|---|---|
| Hungry Horse | 2,980 | 99 | 98 | - | 4 | 285 | 300 | 182 |
| Kerr | 1,217 | 118 | 121 | 17 | 3 | 180 | 180 | 173 |
| Knowles | 3,084 | 153 | 151 | 5 | 4 | 274 | 315 | 208 |
| Winnemile Prairie | 600 | 18 | 19 | 0 | 3 | 60 | 60 | 60 |
| Libby | 5,010 | 192 | 217 | 7 | 4 | 344 | 396 | 182 |
| Long Meadows | 400 | 6 | 6 | 0 | 2 | 18 | 21 | 13 |
| Kootenay Lake | 910 | - | - | - | - | - | - | - |
| Albeni Falls | 1,153 | 30 | 29 | 10 | 3 | 43 | 43 | 26 |
| Enaville | 700 | 21 | 26 | 2 | 2 | 60 | 69 | 44 |
| Coeur d'Alene | 220 | - | - | - | - | - | - | - |
| Grand Coulee | 5,072 | 1,881 | 2,018 | 252 | 24 | 2,880 | 2,880 | 2,707 |
| Chelan | 676 | 42 | 43 | 5 | 2 | 54 | 54 | 50 |
| Brownlee | 1,034 | 165 | 218 | 10 | 4 | 360 | 360 | 214 |
| Nez Perce | 4,500 | 827 | 1,046 | 33 | 12 | 1,800 | 2,070 | 1,633 |
| Wenaha | 900 | 60 | 73 | 7 | 2 | 134 | 154 | 149 |
| Penny Cliffs | 2,300 | 165 | 194 | 12 | 4 | 292 | 337 | 262 |
| Bruces Eddy | 1,433 | 127 | 154 | 16 | 3 | 240 | 276 | 224 |
| Quarts Creek | Pondage | 33 | 40 | 9 | 3 | 78 | 90 | 90 |
| Kootenai Falls | " | 116 | 122 | 5 | 3 | 180 | 207 | 207 |
| Thompson Falls | " | 61 | 58 | 21 | 10 | 67 | 75 | 75 |
| Noxon Rapids | " | 181 | 204 | 8 | 4 | 400 | 400 | 400 |
| Cabinet Gorge | " | 130 | 143 | 8 | 4 | 240 | 240 | 240 |
| Box Canyon | " | 55 | 56 | 14 | 4 | 69 | 69 | 69 |
| Boundary | " | 351 | 400 | 41 | 6 | 600 | 600 | 600 |
| Spokane River | " | 139 | 180 | 44 | - | 307 | 351 | 351 |
| Chief Joseph | " | 1,042 | 1,138 | 106 | 24 | 1,536 | 1,766 | 1,766 |
| Wells | " | 380 | 412 | 34 | 11 | 539 | 620 | 620 |
| Rocky Reach | " | 574 | 623 | 64 | 8 | 813 | 935 | 935 |
| Rock Island | " | 220 | 216 | 44 | 10 | 249 | 269 | 234 |
| Wanapum | " | 476 | 523 | 47 | 10 | 712 | 775 | 775 |
| Priest Rapids | " | 500 | 551 | 49 | 10 | 750 | 801 | 801 |
| Oxbow | " | 102 | 122 | 4 | 4 | 190 | 219 | 219 |
| Hells Canyon | " | 165 | 195 | 3 | 4 | 400 | 400 | 400 |
| China Gardens | " | 77 | 91 | 3 | 3 | 172 | 172 | 172 |
| Asotin | " | 172 | 201 | 11 | 3 | 288 | 331 | 331 |
| Lower Granite | " | 228 | 273 | 15 | 4 | 400 | 460 | 460 |
| Little Goose | " | 238 | 276 | 27 | 4 | 360 | 414 | 414 |
| Lower Monumental | " | 218 | 262 | 19 | 4 | 360 | 414 | 414 |
| Ice Harbor | " | 226 | 268 | 23 | 4 | 360 | 414 | 414 |
| McNary | " | 650 | 752 | 60 | 14 | 980 | 1,127 | 1,127 |
| John Day | " | 958 | 1,130 | 76 | 14 | 1,522 | 1,750 | 1,750 |
| The Dalles | " | 802 | 942 | 64 | 16 | 1,248 | 1,435 | 1,435 |
| Bonneville | " | 551 | 624 | 60 | 13 | 756 | 756 | 756 |
| Gross At Site | 32,189 | 12,549 | 14,215 | 1,235 | - | 20,578 | 22,585 | 21,182 |
| Transmission Losses | - | 439 | 498 | - | - | - | - | 953 |
| Net At Load Center | - | 12,110 | 13,717 | - | - | - | - | 20,229 |

Table 11A

*Corps of Engineer Tabulation

KPDGH
June 1960

TABLE 11B

ADJUSTMENTS MADE IN CORPS OF ENGINEERS
SEQUENCE IV H (SYSTEM B-1, TABLE 11A)
TO OBTAIN PNPC DATA GIVEN IN TABLE 11

1. China Gardens tailwater changed from Elev. 842.5 to Elev. 845 as stipulated in the Washington Prehearing Conference per Transcript Vol. 1, Page 5.

2. Used PNPC pool level of 915 for China Gardens rather than level 895 as used in System B-1 routing. Used Nez Perce regulated flow at China Gardens without deducting 200 cfs for losses as assumed by the Corps, in accordance with item 1 (b), Engineering Items of Agreement, San Francisco, July 11 & 12, 1960.

3. Used PNPC Nez Perce data which are:

   (a) H/K and capability factors.

   (b) Used 11 units rather than 12 units as used in Corps study, including respective hydraulic capacities.

   (c) Used 5,015,000 acre-feet of usable storage rather than 4,500,000 acre-feet as used in Corps study.

   (d) Eliminated 500 cfs loss assumed by the Corps to use 1985 flow in accordance with Item 1 (d), Engineering Items of Agreement, San Francisco, July 11 & 12, 1960.

4. Adjusted Corps routing to reflect use of 515,000 acre-feet additional storage during critical storage period to obtain a uniform monthly adjustment of the Corps Sequence IV H or B-1 System energy outputs. During non-critical storage periods adjusted Nez Perce storage use on basis of runoff forecasts and maintained comparability with PNPC adjusted Sequence IV J or A-1 System Routing.

5. Netted out of Nez Perce Project and returned to the Hells Canyon Project loss of power due to overlap storage.

6. Independent Resources data shown in line 31 of Table 11 are taken from Prehearing Conference Exhibits 12 and 13 and, in addition, include the Chelan plant and the Spokane River plants data contained in Table 11A

Table 11B

August 1, 1960

15099

TABLE 12
HIGH MOUNTAIN SHEEP PLAN POWER PRODUCTION DATA
2017 SYSTEM

| Line | Project | Usable Storage 1000 AF | 48 Mo. Avg. Prime Energy MW | 43 Mo. Max. Mo. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Mica Creek | 11,685 | | | | - | - | - | - |
| 2. | Arrow Lakes | 3,025 | | | | - | - | - | - |
| 3. | Hungry Horse | 2,980 | | | | 4 | 285 | 300 | |
| 4. | Flathead Lake (Kerr) | 1,217 | | | | 4 | 240 | 240 | |
| 5. | Knowles | 3,084 | | | | 8 | 512 | 589 | |
| 6. | Ninemile Prairie | 600 | | | | 3 | 60 | 60 | |
| 7. | Libby | 5,010 | | | | 8 | 688 | 791 | |
| 8. | Long Meadows | 400 | | | | 2 | 18 | 21 | |
| 9. | Kootenai Lake | 910 | | | | 0 | 0 | 0 | |
| 10. | Albeni Falls | 1,153 | | | | 3 | 43 | 43 | |
| 11. | Enaville | 700 | | | | 2 | 60 | 69 | |
| 12. | Coeur d'Alene Lake | 220 | | | | 0 | 0 | 0 | |
| 13. | Grand Coulee | 5,072 | | | | 34 | 4,080 | 4,080 | |
| 14. | Brownlee | 1,034 | | | | 6 | 540 | 540 | |
| 15. | Wenaha | 900 | | | | 3 | 201 | 231 | |
| 16. | Penny Cliffs | 2,300 | | | | 4 | 292 | 337 | |
| 17. | Bruces Eddy | 1,433 | | | | 3 | 240 | 276 | |
| 18. | Quartz Creek | Pondage | | | | 4 | 104 | 120 | |
| 19. | Kootenai Falls | do | | | | 6 | 360 | 414 | |
| 20. | Thompson Falls | do | | | | 10 | 67 | 75 | |
| 21. | Noxon Rapids | do | | | | 5 | 500 | 500 | |
| 22. | Cabinet Gorge | do | | | | 5 | 300 | 300 | |
| 23. | Box Canyon | do | | | | 4 | 69 | 69 | |
| 24. | Boundary | do | | | | 10 | 1,000 | 1,000 | |
| 25. | Chief Joseph | do | | | | 27 | 1,728 | 1,987 | |
| 26. | Wells | do | | | | 16 | 784 | 902 | |
| 27. | Rocky Reach | do | | | | 11 | 1,118 | 1,196 | |
| 28. | Rock Island | do | | | | 10 | 249 | 249 | |
| 29. | Wanapum | do | | | | 16 | 1,140 | 1,170 | |
| 30. | Priest Rapids | do | | | | 16 | 1,180 | 1,180 | |
| 31. | Oxbow | do | | | | 5 | 238 | 273 | |
| 32. | Zells Canyon (before Mt. Sheep) | do | 162 | 213 | 191 | 5 | 435 | 500 | 500 |
| 33. | Independent Resources | 1/ | | | | - | 5,000 2/ | 5,643 | |
| 34. | Sub-Total (lines 1-33) | 41,723 | | | | - | 21,531 | 23,155 | |
| | HIGH MOUNTAIN SHEEP PLAN | | | | | | | | |
| 35. | High Mountain Sheep (Net) | 2,250 | 469 | 718 | 528 | 8 | 1,400 | 1,600 | 1,140 |
| 36. | Lower Canyon | 3,265 | 323 | 495 | 392 | 5 | 875 | 1,000 | 690 |
| 37. | China Gardens | Pondage | 139 | 229 | 162 | 5 | 425 | 500 | 500 |
| 38. | Sub-Total (lines 35-37) | 5,515 | 931 | - | 1,082 | | 2,700 | 3,100 | 2,330 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 39. | Asotin | Pondage | 16.6 | | | 4 | 384 | 442 | |
| 40. | Lower Granite | do | 16.0 | | | 6 | 600 | 690 | |
| 41. | Little Goose | do | 16.2 | | | 6 | 540 | 621 | |
| 42. | Lower Monumental | do | 14.9 | | | 6 | 540 | 621 | |
| 43. | Ice Harbor | do | 15.8 | | | 6 | 540 | 621 | |
| 44. | McNary | do | 11.7 | | | 20 | 1,400 | 1,610 | |
| 45. | John Day | do | 17.6 | | | 28 | 2,174 | 2,500 | |
| 46. | The Dalles | do | 13.8 | | | 22 | 1,716 | 1,958 | |
| 47. | Bonneville | do | 9.2 | | | 16 | 980 | 980 | |
| 48. | Sub-Total (lines 39-47) | 0 | 131.2 | | | - | 8,814 | 9,983 | |
| 49. | Total (lines 34,38,48) | 47,238 | | | | - | 33,045 | 36,238 | |

DATA WERE NOT DETERMINED

1/ Not readily available
2/ Not readily available, therefore estimated at 5000 MW

Table 12

August 1, 1960

15100

[fol. 15101]

TABLE 13
NEZ PERCE PLAN POWER PRODUCTION DATA
2017 SYSTEM

| Line | Project | Usable Storage 1000 AF | 43 Mo. Avg. Prime Energy MW | 43 Mo. Max. Mo. Output MW | Avg. Annual Energy Gener. MW | No. of Units | Plant Name-plate Rating MW | Max. Plant Capability MW | Jan. 1932 Plant Peak Capability MW |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Mica Creek | 11,685 | | | | - | - | - | - |
| 2. | Arrow Lakes | 3,025 | | | | 0 | 0 | 0 | 0 |
| 3. | Hungry Horse | 2,980 | | | | 4 | 285 | 300 | |
| 4. | Flathead Lake (Kerr) | 1,217 | | | | 4 | 240 | 240 | |
| 5. | Knowles | 3,084 | | | | 8 | 512 | 589 | |
| 6. | Ninemile Prairie | 600 | | | | 3 | 60 | 60 | |
| 7. | Libby | 5,010 | | | | 8 | 688 | 791 | |
| 8. | Long Meadows | 400 | | | | 2 | 18 | 21 | |
| 9. | Kootenai Lake | 910 | | | | 0 | 0 | 0 | |
| 10. | Albeni Falls | 1,153 | | | | 3 | 43 | 43 | |
| 11. | Enaville | 700 | | | | 2 | 60 | 69 | |
| 12. | Coeur d'Alene Lake | 220 | | | | 0 | 0 | 0 | |
| 13. | Grand Coulee | 5,072 | | | | 34 | 4,080 | 4,080 | |
| 14. | Brownlee | 1,034 | | | | 6 | 540 | 540 | |
| 15. | Wenatchee | 900 | | | | 3 | 201 | 231 | |
| 16. | Penny Cliffs | 2,300 | | | | 4 | 292 | 337 | |
| 17. | Bruces Eddy | 1,433 | | | | 3 | 240 | 276 | |
| 18. | Quartz Creek | Pondage | | | | 4 | 104 | 120 | |
| 19. | Kootenai Falls | do | | | | 6 | 360 | 414 | |
| 20. | Thompson Falls | do | | | | 10 | 67 | 75 | |
| 21. | Noxon Rapids | do | | | | 5 | 500 | 500 | |
| 22. | Cabinet Gorge | do | | | | 5 | 300 | 300 | |
| 23. | Box Canyon | do | | | | 4 | 69 | 69 | |
| 24. | Boundary | do | | | | 10 | 1,000 | 1,000 | |
| 25. | Chief Joseph | do | | | | 27 | 1,728 | 1,987 | |
| 26. | Wells | do | | | | 16 | 784 | 902 | |
| 27. | Rocky Reach | do | | | | 11 | 1,118 | 1,196 | |
| 28. | Rock Island | do | | | | 10 | 249 | 249 | |
| 29. | Wanapum | do | | | | 16 | 1,140 | 1,170 | |
| 30. | Priest Rapids | do | | | | 16 | 1,180 | 1,180 | |
| 31. | Oxbow | do | | | | 5 | 238 | 273 | |
| 32. | Hells Canyon (before Nez Perce) | do | 162 | 213 | 191 | 5 | 435 | 500 | 500 |
| 33. | Independent Resources | 1/ | | | | | 5,000 2/ | 5,683 | |
| 34. | Sub-Total (lines 1-33) | 41,723 | | | | | 21,531 | 23,155 | |
| | NEZ PERCE PLAN | | | | | | | | |
| 35. | Nez Perce (net) | 5,015 | 765 | 1,176 | 899 | 13 | 2,145 | 2,470 | 1,760 |
| 36. | China Gardens | Pondage | 102 | 171 | 120 | 5 | 325 | 375 | 375 |
| 37. | Sub-Total (lines 35,36) | 5,015 | 867 | - | 1,019 | - | 2,470 | 2,845 | 2,135 |
| | DOWNSTREAM PLANTS | | | | | | | | |
| 38. | Asotin | Pondage | 15.1 | | | 4 | 384 | 442 | |
| 39. | Lower Granite | do | 14.5 | | | 6 | 600 | 690 | |
| 40. | Little Goose | do | 14.7 | | | 6 | 540 | 621 | |
| 41. | Lower Monumental | do | 13.6 | | | 6 | 540 | 621 | |
| 42. | Ice Harbor | do | 14.3 | | | 6 | 540 | 621 | |
| 43. | McNary | do | 10.7 | | | 20 | 1,400 | 1,610 | |
| 44. | John Day | do | 15.5 | | | 20 | 2,174 | 2,500 | |
| 45. | The Dalles | do | 12.6 | | | 22 | 1,716 | 1,958 | |
| 46. | Bonneville | do | 8.3 | | | 16 | 920 | 920 | |
| 47. | Sub-Total (lines 38-46) | 0 | 119.3 | | | | 8,814 | 9,983 | |
| 48. | Total (lines 34,37,47) | 46,738 | | | | | 32,815 | 35,983 | |

DATA WERE NOT DETERMINED

1/ Not readily available
2/ Not readily available, therefore estimated at 5000 MW

August 1, 1960

15101

[fol. 15210] Sheet 1 of 5

PNPC EXHIBIT 37

# THE NEZ PERCE PROJECT

## MORE ACTION AND LESS CONTROVERSY NEEDED

Presented at the
Northwest Public Power Association
Annual Membership Meeting

Eugene, Oregon

April 6, 7 and 8, 1960

by Owen W. Hurd, Managing Director
Washington Public Power Supply System

Panel Chairman, Mr. Cleaveland, Panel Members and Ladies and Gentlemen of the NWPPA Convention. It is my privilege and assignment to discuss the key element of the Middle Snake River development and the purpose and philosophy underlying the FPC license application by the Washington Public Power Supply System to construct this great Nez Perce Project.

Mr. Cleaveland has oriented you with regard to its location below the confluence of the Salmon and Snake Rivers between Oregon and Idaho and a few miles below the southeast corner of the State of Washington. He has also indicated that the project layout contained in the Corps of Engineers current "308" Review Report would result in a 700 foot high dam, impounding four and one-half million acre feet of usable storage, with an initial installed capacity of 1,200,000 kw and an ultimate capacity of 2,550,000 kw. Of course these plans provide for facilities to satisfactorily pass migratory fish. The Corps estimated the project would result in annual flood control benefits amounting to $5,900,000, power benefits of $38,100,000 and recreation benefits of $115,000. Annual costs would be $13,700,000 and the project would have a benefit to cost ratio as a federal project of 3.21 to 1.

It is not necessary to dwell on the recognized superiority of the Nez Perce Project. All agencies, including the Corps of Engineers, the Federal Power Commission staff and the Oregon Water Resources Board who have studied potential unlicensed projects in the Middle Snake, have concluded that any combination of projects which includes the Nez Perce is superior to any combination of projects that does not include the Nez Perce.

The Federal Power Commission in denying the Pacific Northwest Power Company a license to build the Mt. Sheep and Pleasant Valley Projects (which would prohibit the construction of the Nez Perce Project) did so without prejudice to the Company making an application to construct the Nez Perce Project.

The FPS staff in 1957 pointed out that:

[fol. 15211] Sheet 2 of 5

1. The Nez Perce Project was feasible for non-federal public or private construction.
2. The flood control benefits of the Nez Perce Project were urgently needed.
3. The problems of fish passage presented by the Nez Perce Project were no different than at the Brownlee Dam of the Idaho Power Company upstream from the Nez Perce Project on the Snake River.
4. Recent biological and engineering accomplishments justify confidence that satisfactory means of passing downstream migrants at Nez Perce can be developed.

In spite of this clear invitation by this agency charged by Congress with the responsibility for maximum comprehensive development of the nation's water resources to file on the Nez Perce Project, the Company after nearly two years of delay made application to construct the inferior Mt. Sheep Project.

The Corps of Engineers after amply documenting the superiority of the Nez Perce Project chose to ignore their

own persuasive arguments in favor of the Nez Perce and have recommended the inferior Mt. Sheep Project as an element in the Major Water Plan. The Corps Review Report and recommendations are now being studied by the Governors of the Northwest States. Congress is not expected to have an opportunity to act on the Review Report during this session of Congress.

As amended, Senate Concurrent Resolution 35 would hold up licensing of projects on the Middle Snake until Congress has had time to act upon the Corps of Engineers Review Report and provide for an accelerated fisheries research program, is now in the Senate Interstate and Foreign Affairs Committee. The NWPPA has actively supported this resolution in hearings in Washington, D. C. and the Northwest. It is doubtful that Congress will take favorable action on this resolution. We hope the Association will continue to support Senate Concurrent Resolution 35.

Senate Bill 2586 would create a fish sanctuary on the Salmon River and would have the immediate effect of forever blocking the Nez Perce Project and delay for many years, if not forever, the construction of any sizeable project on the Salmon River. This bill is also presently in the Senate Interstate and Foreign Affairs Committee. This bill, although intended as a conservation measure, would actually be in direct opposition to true conservation and maximum use of our water resources.

It will be recalled that the excuse the FPC Examiner in the High Hells Canyon Hearings gave for recommending the three low dams to the Idaho Power Company was that neither Congress nor any other agency was proposing to build the vastly superior High Hells Canyon Project. Many believe that had local public agencies applied for a license to construct the High Hells Canyon Project, a full and orderly development of the Middle Snake would have been assured.

[fol. 15212] Sheet 3 of 5

The intervention of NWPPA and the National Hells Canyon Association in the Mt. Sheep application faced a costly, futile and unrealistic prospect to prevent the issuance of a license for the Mt. Sheep Project. It was with full knowledge and awareness of this situation and circumstances that the Executive Committee of the NHCA met in Portland on February 18th and unanimously recommended that the Washington Public Power Supply System make application to FPC for a license to construct the Nez Perce Project.

This recommendation did not take WPPSS by surprise. Since its organization in 1957 the problems and feasibility of such a filing on the Nez Perce had been considered. The invitation of FPC in 1957 to the Pacific Northwest Power Company to file on Nez Perce and denying the low Mt. Sheep application stimulated these considerations and the matter was discussed rather widely throughout the region. We expected that the Corps in its Review Report would take an uncompromising stand in favor of the Nez Perce Project and federal authorization. This argued against a filing on Nez Perce. When the Corps failed to take such a stand, S. Con. Res. No. 35, which would delay the licensing of the Mt. Sheep Project, was considered preferable to a filing. With legislative action to save Nez Perce moving slowly and proceedings before FPC on the Mt. Sheep application accelerating, it was obvious that the time for action on a Nez Perce filing by a non-federal public agency was at hand.

WPPSS moved swiftly and on March 15th (3 weeks and 2 days after the decision was made by the Board of Directors) an application to construct the great Nez Perce Project was filed with the Federal Power Commission in Washington, D. C.

It is generally recognized by all familiar with the situation that the action taken is a positive, constructive and sound means of insuring proper consideration by FPC on

the Nez Perce Project and development of the Middle Snake in the best public interest.

However, this action has also been accompanied by honest and sincere expressions of concern by some and, of course, some out-right criticism by a few who are not concerned with maximum usage of our water resources and the value of low cost power to the economy of our region.

I would like to devote the time remaining to me on this panel to briefly state our position with regard to those matters which appear to be of greatest concern to those desiring to make an objective evaluation of the merits of the WPPSS proposal to construct the Nez Perce Project.

First, there is the concern about the market and power allocation for a project utilizing the water resources common to three states by a municipal corporation composed of Public Utility Districts in the State of Washington.

Our position with regard to power allocation and power marketing can be summarized as follows:

1. Low cost power from the Nez Perce Project as it becomes available will go to industrial users and public and private utilities who have executed power pur-

[fol. 15213] Sheet 4 of 5

chase contracts at the time the project is financed by the sale of revenue bonds.

2. It is obvious that industries and utilities foreseeing the greatest need and benefit from this low cost source of power will have the greatest incentive to execute power sales contracts. Power from this project, as with all other projects, will go where the need exists and where economics dictates regardless of geographical or political boundaries. This has been true of federal projects and the large Columbia River projects of Grant and Chelan PUDs as well as the Pend Oreille PUD Box Canyon Project.

3. Public agencies in the Northwest participating with WPPSS in the development of this project will have

equal opportunity to share in the future benefits of the project.

4. This is equally true whether these agencies are in Oregon, Idaho or Western Montana. The main point is that when fuller development of any site is achieved, we have a bigger power pie to cut.

5. The downstream benefits will be equal to another Bonneville Dam, creating still more kilowatts to distribute.

The possible use of low cost Nez Perce power to develop and conserve the recovery of chemical and fertilizer phosphates from the low grade ore in southeastern Idaho will not be ignored. Surveys and appraisals will be made to fully explore this market.

Nez Perce power will become available at a time when power contracts for Northwest aluminum plants expire and when it is expected there will be a need for additional aluminum production capacity. The retention of present plants and their expansion by low cost power will benefit the entire region.

We have noted the commendable efforts of Governor Hatfield and business leaders in Oregon in an aggressive and forthright effort to create jobs and economic opportunities by inviting industrial and business expansion in Oregon. We hope that public and private utilities in Oregon, as well as in Idaho, Washington and Western Montana, will seize the opportunity to aid the efforts of Governor Hatfield and others by cooperating in the development and use of Nez Perce power.

Another concern is the possible adverse effect the Nez Perce Project might have on future salmon reproduction in the upper reaches of the Salmon River. Our position on the fish problem can be stated as follows:

1. The fisheries industry is important to many areas served by public and cooperative power agencies,

particularly along the Coast. We have a great stake in not only protecting the fisheries industry, but in
[fol. 15214]

expanding it. It has been said that power and fish are in conflict. What often is overlooked is that floods kill off fish in great numbers. Therefore, as we achieve flood control, we improve conditions for a bigger and healthier fishing industry.

2. A proposal for fish passage facilities to be incorporated in the design of the Nez Perce Dam utilizing methods of advanced and proven performance will shortly be submitted to the Federal and state fish agencies.

3. It is expected that testimony to be presented during the Nez Perce-Mt. Sheep hearings will bring into sharp focus the progress which has been made and the success achieved in passing fish over dams as well as the significance of recent developments in fields of stream improvement, disease control, artificial spawning grounds, fish farming and scientific management of our fish resources.

The inflexible laws of physics and hydrological factors determine and limit the conversion of our water resources to electric energy. The intelligent and diligent application of knowledge already gained and yet to be disclosed by research and study is the only limiting factor to the expansion and improvement of our fisheries resources. The picture has never been so encouraging for the full development of our potential water energy in complete harmony and with full protection and maximum expansion of our fisheries resources. Engineers and biologists working together have and will continue to perfect more effective means of harnessing the total benefits to be obtained from our water resources in the best public interest.

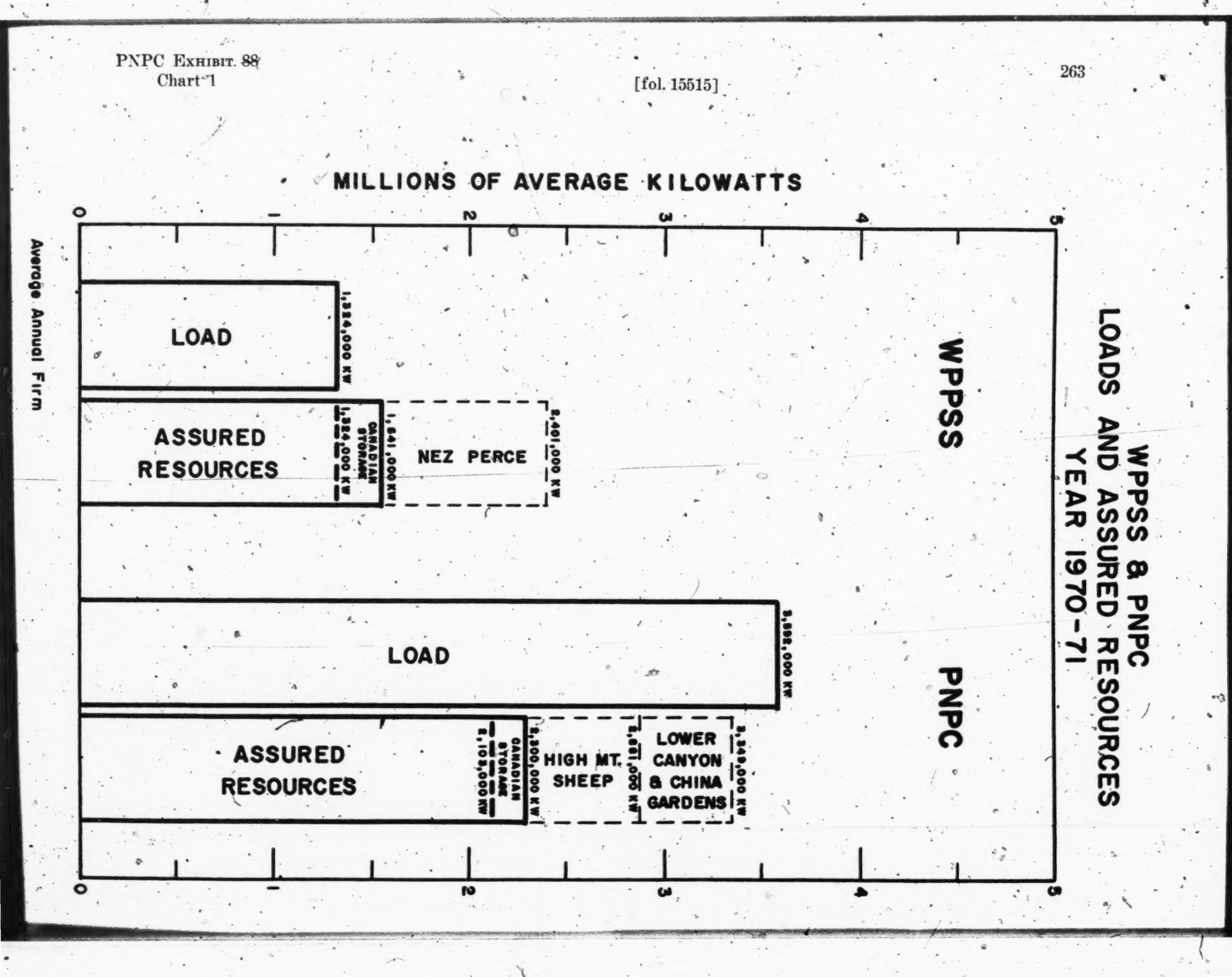
Another concern on the part of some is that the Nez Perce application will result in a delay in bringing into

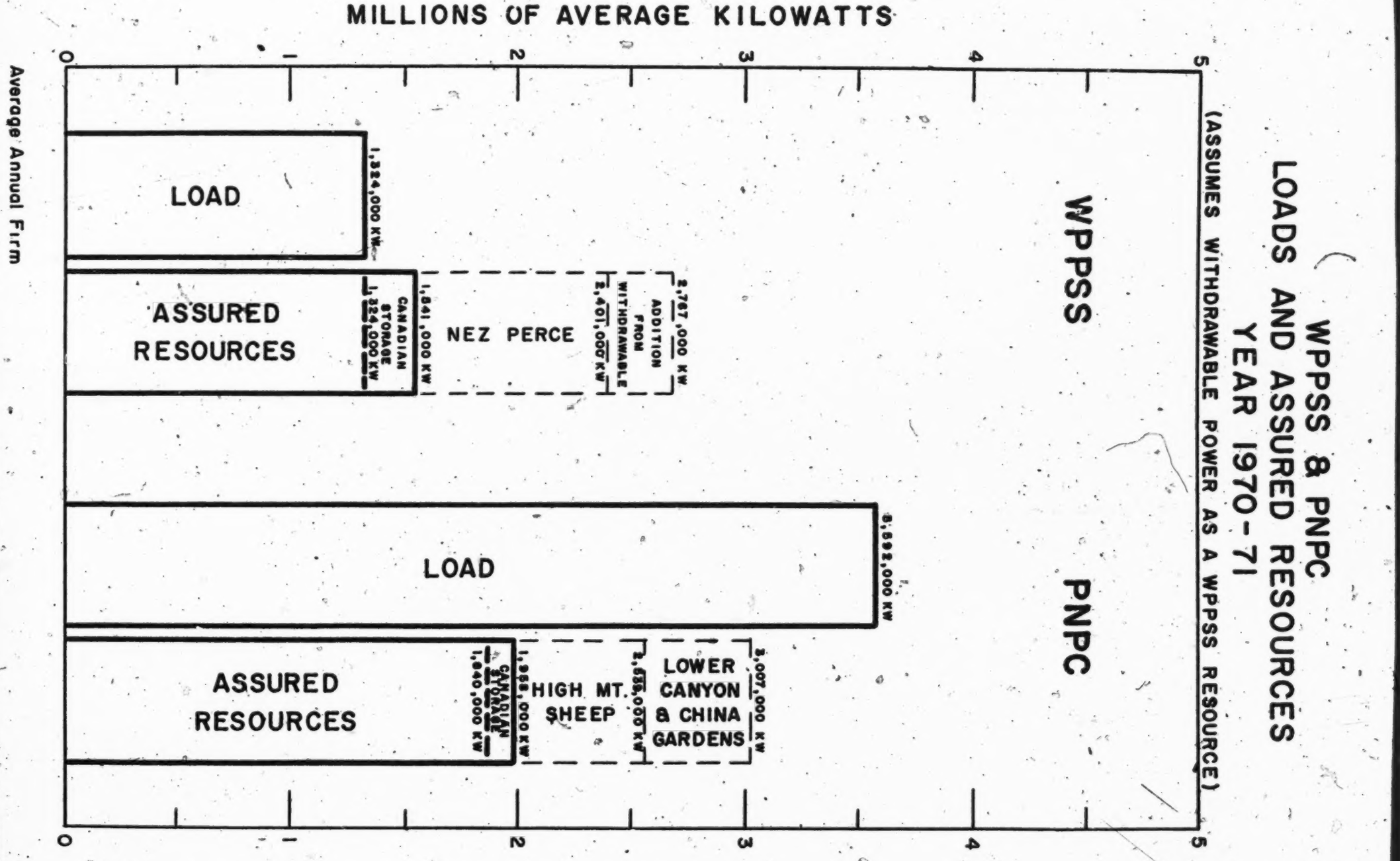
production a source of power from the Middle Snake. To this, our answer is that with the full cooperation of all concerned, Nez Perce power can be put on the line as early as any alternate and lesser project in the same reach of the Snake River. We will work to make this become a reality.

The Nez Perce is only one of several large unscheduled projects that will be required to meet the region's growing power requirements during the next ten years. Present estimates are that more than three million kilowatts of additional firm capacity will be required before 1970. The Nez Perce Project can supply one-third of the needed new capacity.

The Nez Perce does not have to be the next project developed in the region. There are alternative sites where we know we can achieve full development, such as Bruce's Eddy and Lower Monumental, not to mention the seven hundred thousand to nine hundred thousand kilowatt Hanford reactor.

The superiority of Nez Perce is unquestioned. The region needs this project for flood control and the benefits of the low cost power it can provide. The fish problems can be satisfactorily solved. What is needed is more cooperation and less controversy!


WPPSS & PNPC
LOADS AND ASSURED RESOURCES
YEAR 1970-71
WPPSS
PNPC
MILLIONS OF AVERAGE KILOWATTS
0
1
2
3
4
5
Average Annual Firm
LOAD
1,324,000 KW
ASSURED RESOURCES
1,324,000 KW
CANADIAN STORAGE
1,841,000 KW
NEZ PERCE
2,401,000 KW
LOAD
3,888,000 KW
ASSURED RESOURCES
2,105,000 KW
CANADIAN STORAGE
2,200,000 KW
HIGH MT. SHEEP
2,681,000 KW
LOWER CANYON & CHINA GARDENS
3,249,000 KW


WPPSS & PNPC
LOADS AND ASSURED RESOURCES
YEAR 1970-71
(ASSUMES WITHDRAWABLE POWER AS A WPPSS RESOURCE)
WPPSS
PNPC
MILLIONS OF AVERAGE KILOWATTS
Average Annual Firm
0
1
2
3
4
5
LOAD
1,324,000 KW
ASSURED RESOURCES
CANADIAN STORAGE 1,324,000 KW
1,841,000 KW
NEZ PERCE
2,401,000 KW
ADDITION FROM WITHDRAWABLE
2,787,000 KW
LOAD
8,682,000 KW
ASSURED RESOURCES
CANADIAN STORAGE 1,840,000 KW
1,988,000 KW
HIGH MT. SHEEP
2,535,000 KW
LOWER CANYON & CHINA GARDENS
3,007,000 KW

FPC Exhibit 23
Table 2

## Comparison of Power Output Data of the Army, P.N.P.Co., W.P.P.S.S. and F.P.C.

### 1984-85 Conditions

### Plan A-1 (or A-2) (with High Mountain Sheep and Lower Canyon)

| Line No. | Data by | Army** (PNPCo Plan A-1) | | | | | PNPCo.* | | | | | WPPSS** | | | | | FPC** | | | | | Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Reference | FPC letter of June 28, 1960 | | | | | Tables 2.4 and 10 of PNPCo. Exhibit 18 | | | | | WPPSS Exhibits Nos. 58, 60 and Replications | | | | | PNPCo regulation study as adjusted by FPC Staff | | | | | |
| | Pertinent Data | (1) Inst. Cap. mw | (2) Normal Pool Elev. Ft. | (3) Min. Power Pool Elev. Ft. | (4) Total Stg. 1000 AF | (5) Usable Stg. 1000 AF | (1) Inst. Cap. mw | (2) Normal Pool Elev. Ft. | (3) Min. Power Pool Elev. Ft. | (4) Total Stg. 1000 AF | (5) Usable Stg. 1000 AF | (1) Inst. Cap. mw | (2) Normal Pool Elev. Ft. | (3) Min. Power Pool Elev. Ft. | (4) Total Stg. 1000 AF | (5) Usable Stg. 1000 AF | (1) Inst. Cap. mw | (2) Normal Pool Elev. Ft. | (3) Min. Power Pool Elev. Ft. | (4) Total Stg. 1000 AF | (5) Usable Stg. 1000 AF | |
| 1 | WHITEBIRD | | | | | | | | | | | | | | | | | | | | | 1 |
| 2 | NEZ PERCE | | | | | | | | | | | | | | | | | | | | | 2 |
| 3 | HIGH MT. SHEEP | 1225 | 1510 | 1337 | 3600 | 2250 | 1225 | 1510 | 1337 | 3600 | 2250 | 1200 | 1510 | 1490 | 3600 | 520 | 1225 | 1510 | 1337 | 3600 | 2250 | 3 |
| 4 | LOWER CANYON (3.7) | 700 | 1595 | 1270 | 3820 | 3265 | 700 | 1595 | 1270 | 3820 | 3265 | | | | | | 700 | 1595 | 1270 | 3820 | 3265 | 4 |
| 5 | LOWER CANYON (2.5) | | | | | | | | | | | 800 | 1575 | 1438 | 3700 | 1890 | | | | | | 5 |
| 6 | CHINA GARDEN 3 | 255 | 945 | — | Pond | Pond | 255 | 945 | — | Pond | Pond | 205 | 925 | — | Pond | Pond | 255 | 945 | — | Pond | Pond | 6 |
| | | (1) | (2) | (3) Jan. 1932 Peak. | (4) L Ex.- EOCP Peak. | | (1) | (2) | (3) Jan. 1932 Peak. | (4) L EOCP Peak. | | (1) | (2) | (3) Jan. 1932 Peak. | (4) L EOCP Peak. | | (1) | (2) | (3) Jan. 1932 Peak. | (4) L EOCP Peak. | | |
| | Power Output Data | Nom. Prime mw | Usable Energy mw | Cap. mw | Cap. mw | | Nom. Prime mw | Usable Energy mw | Cap. mw | Cap. mw | | Nom. Prime mw | Usable Energy mw | Cap. mw | Cap. mw | | Nom. Prime mw | Usable Energy mw | Cap. mw | Cap. mw | | |
| 7 | CREVICE | | | | | | | | | | | 278 | 343 | 393 | | | 280 | 352 | 498 | 426 | | 7 |
| 8 | FREEDOM | | | | | | | | | | | 114 | 135 | 207 | 207 | | 114 | 128 | 208 | 208 | | 8 |
| 9 | WHITEBIRD | | | | | | | | | | | | | | | | | | | | | 9 |
| 10 | HELLS CANYON | 167 | 196 | 400 | 400 | | 12 170 | 12 205 | 400 | 400 | | 12 170+ | 12 205+ | 400 | 400 | | 12 170 | 12 205 | 400 | 400 | | 10 |
| 11 | NEZ PERCE | | | | | | | | | | | | | | | | | | | | | 11 |
| 12 | HIGH MT. SHEEP | 488 | 600 | 938 | 851 | | 13 491 | 13 584 | 956 | 868 | | 13 495 | 13 610 | 1200 | | | 13 491 | 13 584 | 956 | 868 | | 12 |
| 13 | LOWER CANYON (3.7) | 325 | 413 | 416 | 361 | | 309 | 401 | 423 | 372 | | | | | | | 370 | 476 | 500 | 400 | | 13 |
| 14 | LOWER CANYON (0.5) | | | | | | | | | | | 388 | 455 | 740 | | | | | | | | 14 |
| 15 | CHINA GARDENS | 147 | 171 | 300 | 300 | | 143 | 169 | 300 | 300 | | 118 | 140 | 236 | 236 | | 151 | 169 | 300 | 300 | | 15 |
| 16 | SUB-TOTAL | 1127 | 1380 | 2054 | 1912 | | 1113 | 1359 | 2079 | 1940 | | 1563 | 1888 | 3176 | | | 1576 | 1914 | 2862 | 2602 | | 16 |
| 17 | DOWNSTREAM PLANTS | 4076 | 4731 | 7101 | 7101 | | 4076 | 4753 | 7101 | 7101 | | 4050 | 4747 | 7101 | 7101 | | 4152 | 4753 | 7101 | 7101 | | 17 |
| 18 | TOTAL | 5203 | 6111 | 9155 | 9013 | | 5189 | 6112 | 9180 | 9041 | | 5613 | 6635 | 10277 | | | 5728 | 6667 | 7963 | 9703 | | 18 |

* Without CREVICE, FREEDOM
** With CREVICE, FREEDOM
1/ EOCP - End of Critical Period
2/ Before HIGH MOUNTAIN SHEEP.
3/ Net; i.e., after deducting power losses at HELLS CANYON due to overlap by HIGH MOUNTAIN SHEEP reservoir.
\+ Data inserted by FPC staff.

Date 9-12-60

[fol. 16808]



PNPC EXHIBIT 5

[Emblem]

HEADQUARTERS

DEPARTMENT OF THE ARMY

OFFICE OF THE CHIEF OF ENGINEERS

WASHINGTON 25, D. C.

IN REPLY REFER TO
ENGWD

Subject: Columbia River and Tributaries

To: THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report with accompanying papers on the Columbia River and tributaries, in response to a resolution adopted 28 July 1955 by the Committee on Public Works of the United States Senate, and to other resolutions by that Committee and by the Committee on Public Works of the House of Representatives listed in the accompanying report of the Board of Engineers for Rivers and Harbors. These resolutions requested review of the report on the Columbia River and tributaries, published as House Document Numbered 531, 81st Congress, 2nd Session, and other reports, with a view to determining the advisability of modifying the existing project in any way at this time, particularly with regard to present requirements for flood control, including consideration of flood storage in Canada; the present needs of navigation; a restudy of hydroelectric power potentialities as part of a combined hydro-thermal system; and consideration of all related water uses.

2. This report, and the accompanying reports of the Board of Engineers for Rivers and Harbors and the Division Engineer, North Pacific Division, constitute an exhaustive study of the rapidly developing Columbia River

Basin in the United States, and of the needs for development of its water resources, with consideration of storage potentialities in Canada. This report is concerned generally with basin-wide planning for the major water uses in the United States rather than solutions for the individual sub-basin problems. Modification and expansion of the authorized Federal project for the Columbia River Basin is found advisable in view of the trends of development and the needs of the regional economy that can be foreseen. The Major Water Plan proposed in this report, composed of existing, authorized, and reasonably assured improvements supplemented by the recommended additional reservoir and other projects, will provide the basis for a sound and integrated system of projects to meet the near-future needs of the basin in the United States. Two major Canadian projects, Mica Creek Dam and the Arrow Lakes development, have been included in studies made in connection with this report as firm potentials for future development. The other Canadian projects now under study have been omitted as too indefinite at this time to warrant consideration in a comprehensive development plan for the Columbia Basin in the United States. Certain modifications of the authorized plan for the Willamette sub-basin are also recommended. Solutions to problems in

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other sub-basins for the most part will require additional study. The Major Water Plan is not intended to be a plan for the ultimate development of the water resources of the basin. We may expect some of the projects to be constructed and others to be eliminated for various reasons. Another study will be required in about ten years to determine what changes and additional projects may be required in the light of the then existing basin development and further development which might be expected at that time. The projects included in the Major Water Plan represent, in each instance, the maximum development considered feasible, practicable, and economically justified. None will pre-

clude or make unduly costly another project that should be constructed later. To the extent practicable, the project with the highest benefit-cost ratio should be built first, and others in descending order of benefit-cost ratios. However, overriding considerations frequently prevent this theoretically desirable procedure. A schedule for constructing projects has not been included in the report because it is intended that successive projects be initiated in time to meet the predicted regional power load. This is done as part of the process of seeking appropriations for the design and initial construction of each project. The schedule can be accelerated or drawn out in tune with the situation at the time.

3. The report of the Division Engineer was prepared with the valuable assistance and cooperation of other Federal and State agencies concerned with the development of the water resources of the Columbia River Basin. Federal agencies that participated in the investigation included the Bonneville Power Administration, the Bureau of Reclamation, the Fish and Wildlife Service, and the National Park Service of the Department of the Interior; the Forest Service and the Soil Conservation Service of the Department of Agriculture; the Federal Power Commission; and the Public Health Service of the Department of Health, Education and Welfare. The fish and wildlife agencies of the States of Idaho, Montana, Oregon, and Washington also assisted. A General Advisory Committee composed of representatives of the Governors of Idaho, Montana, Oregon, Washington, and Wyoming, Federal agencies, non-Federal power groups, and other interested agencies, was formed by the Division Engineer to advise on general policy matters. In addition, an Advisory Committee on Fish and Wildlife, representing Federal and local agencies, and a Technical Advisory Committee on Power were organized. A Consulting Board of nationally prominent engineers gave general technical assistance. Consideration was given to progress and developments on the international aspects of the basin and of possible storage projects in Canada through

liaison with Canadian interests under procedures established by the International Joint Commission.

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4. In addition to coordination with and participation by these agencies, the Division Engineer held two series of public hearings to obtain the views of local interests during the investigations. Hearings were held at Missoula, Montana; Spokane and Wenatchee, Washington; Lewiston and Boise, Idaho; and Portland, Oregon. Subsequently, during the review of the Division Engineer's report, the Board of Engineers for Rivers and Harbors held public hearings at Missoula, Montana; Lewiston, Idaho; Portland, Oregon; and Washington, D. C., to obtain the views of interested parties in the proposed development and to obtain additional information. Full opportunity was given to all interests to express their views and these views have been thoroughly considered in reaching the conclusions in this report.

5. Since submission of the report in House Document No. 531, 81st Congress, in 1950, the pace of economic development in the Columbia River Basin and in the remainder of the Pacific Northwest has accelerated. The trends of economic activity now apparent indicate more clearly the prospective needs of the regional economy for an expanded plan of water resource development. Population, industry, and agriculture in the region have grown at a rate faster than the average for the nation. Further economic expansion in this region is dependent upon the carefully planned and coordinated use of all available resources. I am confident that the Pacific Northwest will show greater gains in population, industry and general economic well-being during the next fifty years than the average in the United States.

6. Acceleration in development has been in no small measure to the availability of large amounts of low cost hydroelectric power, which encouraged aluminum production in the area during World War II. The influx of in-

vestment capital and a skilled labor force created the nucleus for postwar development. Large amounts of land, water, and other natural resources of forests and mines constitute the base for an integrated, expanding, and sound economy. The characteristics and needs of the region have stimulated an upward trend of growth that is expected to continue. The availability of the major factors of production, such as capital, labor, and raw materials, including water, and the stimulus of progressive management and Government cooperation, assure continued growth, providing that no single element is allowed to lag. A forward-looking program for water resources development is essential to assure the optimum development of the Pacific Northwest region and the nation. Sound water resource development in the Columbia River Basin can be achieved by a program of coordinated water resource improvements, incorporating a balancing of the demands for navigation, flood control, hydroelectric power, fish and wildlife conservation, recreation, water supply and pollution abatement.

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7. Floods in the Columbia River Basin cause damage at many localities. However, the major damage occurs in the areas along the 140-mile reach of the Columbia River downstream from Bonneville Dam. About 60 percent of the overflow area in this reach is partially protected by levees and upstream storage regulation. Reservoir projects existing and under construction presently provide a total of about 8 million acre-feet of storage capacity usable for flood control, an amount which will regulate a flood of 1894 magnitude, the maximum of record, which had a flow of 1,240,000 cubic feet per second at The Dalles, Oregon, to a flow of 1,030,000 cubic feet per second at that point. Although the projects existing and under construction will afford some flood protection, extensive damage would still result from a major flood. Engineering and economic considerations limit safe levee capacity generally to a flow of 800,000 cubic feet per second at The Dalles. This degree of control is considered an acceptable and desirable immediate goal for

flood regulation. A total of about 18 million acre-feet of usable storage, of which about 4.5 million acre-feet should be located upstream from Grand Coulee Dam, is required to obtain this degree of control at The Dalles. Of the total, about 10.5 million acre-feet will be available from projects existing or under construction, including modification of Grand Coulee Dam to provide 20 additional operating outlets now under consideration by the Bureau of Reclamation. Regulation of a flood of 1894 magnitude to a flow of 600,000 cubic feet per second at The Dalles is a desirable further goal in view of the trends of future flood plain use, as well as the possibility that a considerably larger flood than the record flood of 1894 might occur very infrequently. The total usable storage required to regulate the 1894 flood to 600,000 cubic feet per second at The Dalles is about 32.4 million acre-feet, of which about 11.2 million acre-feet are existing or under construction. Therefore, usable storage of about 21.2 million acre-feet in addition to the storage in projects existing and under construction would be required to meet this goal.

8. Use of the Columbia River for navigation has increased with the economic growth of the region and improvement of the river. Commerce moving by barge through the Bonneville Locks now approximates 1,500,000 tons annually. Waterborne commerce is expected to increase rapidly upon the completion of the authorized slack-water project to Pasco, Washington, and Lewiston, Idaho. The improvements under consideration for extension of navigation on the Columbia River above the McNary project and on the Snake River above Lewiston would permit the movement by water of the products and requirements of a larger tributary area.

9. The power requirements of the Pacific Northwest are now almost entirely supplied from hydroelectric sources. The power load has increased rapidly over the past decade and forecasts indicate that a large additional capacity will

be required to meet future needs. In 1957 the regional power load amounted to about 5,400,000 kilowatts of average generation. Load growth forecasts indicate that the regional power load might increase to more than 16 million kilowatts by 1975, to about 23 million kilowatts by 1985, and to about 56 million kilowatts by 2010. These amounts are the maximum estimates given in the Division Engineer's report. This projected increase in power requirements is far greater than the amount that can be supplied from hydro sources alone. Development of the region's water resources should provide for early utilization of the hydro resources with full recognition of the need for them to operate in a future hydro-thermal power system. In such a system, hydroelectric plants can be used most effectively to meet peak loads and, although the value of a unit of storage for power purposes will diminish progressively as total available storage increases, the value of at-site hydroelectric power will increase.

10. Irrigation has long been practiced in the basin to increase agricultural production. More than 5 million acres of farmland are irrigated in the United States portion of the Columbia River Basin. Projections for the year 2010 indicate that nearly 9 million acres will be irrigated. Additional storage and economical power will be required to meet the prospective needs of irrigation.

11. The abundance of fish and wildlife in the Columbia Basin is a major economic and recreational resource. Increased population, leisure time, and ready access are placing heavier demands on public recreational facilities. Although water-enhanced recreational opportunities are plentiful in the basin, the immediate use of each new water area demonstrates the intensity of interest and needs. Development of the water resources for the area's basic economic needs must recognize and take into account the recreational and fish and wildlife resources to insure that these resources are conserved and enhanced.

12. Water for domestic and industrial use in the Columbia Basin generally is available in ample supply from surface and ground-water sources to meet present and foreseeable needs. These needs, however, will increase and may become critical in some localities in the future. The storage needs for these purposes, in addition to those of other uses, probably will not be large, and it is expected that they will be served satisfactorily by the Major Water Plan.

13. Pollution of streams in the Columbia Basin is a problem in only a few areas, but it will become of greater concern with the growth of population and industry. Increased stream flow from upstream regulation will be valuable in helping to alleviate the pollution problems.

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14. The Division Engineer has proposed a Major Water Plan for development of the water resources to meet the economic needs of the Columbia River Basin in the United States. The projects included in the Major Water Plan are listed in Tables 47 and 48 of the Division Engineer's report. This plan includes a group of projects proposed for authorization which, together with the projects completed, under construction, and reasonably assured, will provide further economic utilization of the resources of the Columbia River Basin within the United States. The additional projects selected by the Division Engineer for inclusion in the Major Water Plan are tabulated, and what they are expected to accomplish is discussed, in the report of the Board of Engineers for Rivers and Harbors.

15. The formulation of a comprehensive plan which would provide for the best utilization of the water resources of the Columbia River Basin requires consideration of the entire basin in the United States and Canada as a whole. However, plans for development of the storage potential in Canada are still under study by Canadian agencies. The contribution that storage projects in the Columbia River Basin in Canada would make in reducing

flood flows and increasing power production at downstream sites in the United States has been considered on the basis of the preliminary information available. The effect of any Canadian storage that might be constructed in the basin is such that adjustments in the plans for storage in the United States can be made if and when arrangements are completed for assured operation of Canadian storage for downstream benefits in the United States. Canadian storage should be considered as a complement to, rather than a substitute for, projects in the Major Water Plan. Excellent progress is being made in reaching an agreement with Canada in this matter. The difficult problem of financing projects in Canada will remain for solution after the agreement on apportionment of benefits and costs has been reached. Nevertheless, timing of construction of new projects is so important that it would be a mistake to delay the construction of projects in the United States in the expectation that future storage or diversion projects in Canada will provide a more economical and satisfactory solution to either flood control or power problems in the United States.

16. The anadromous fishery in the Columbia River Basin is recognized as a major natural resource. In considering improvements for development of the water resource potential, careful consideration has been given to the fishery resource and to the problem of passing migrants over high dams, especially passing downstream migrants without excessive losses. The proposed Nez Perce project, which would be located below the confluences of the Salmon and Imnaha Rivers with the Snake River, would intercept about

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43 percent of the anadromous fish passing over McNary Dam. Of the anadromous fish passing McNary Dam, about 28 percent go up the Salmon River, 3 percent up the Imnaha River, and 12 percent up the Snake River above the Imnaha River. From the viewpoint of flood control and power the Nez Perce project, if constructed in the near

future, would provide the optimum development of this reach of the lower Middle Snake River. However, the problem of passing migratory fish at high dams, in the opinion of authoritative sources, cannot be resolved in less than 8 to 10 years, and, because of the unique fisheries problem presented, they state that at least 15 to 20 years might be necessary to resolve the problem that would be created by the Nez Perce project. The water resource potential of the lower Middle Snake Basin also can be realized through construction of the High Mountain Sheep Dam on the Snake River and the Lower Canyon Dam on the Salmon River. This combination will produce greater benefits than the Nez Perce project but at a greater cost and a lower benefit-cost ratio. Since the preparation of the Division Engineer's report, the results of additional investigations at the High Mountain Sheep and Lower Canyon sites have become available, which indicate rather conclusively that a concrete arch dam is feasible at the High Mountain Sheep site. This dam, built to provide a full pool at elevation 1510, would cost roughly $44 million less than the concrete gravity section dam proposed by the Division Engineer, but raised to the same elevation ($198 million vs. $242 million). There is some chance that an arch dam also might be substituted for the more expensive gravity section dam at the Lower Canyon site, but a conclusion cannot be reached until further borings are made. This additional study can wait until the advance engineering and design stage immediately prior to initiating construction. Even with the reduced cost of High Mountain Sheep Dam, the combination of that dam with Lower Canyon Dam would still cost more than Nez Perce Dam ($384 million vs. $296 million, with the Snake River reservoirs at elevation 1510). The combination also would have a lower benefit-cost ratio than Nez Perce (2.45 to 1 vs. 3.20 to 1) if we assume that either of the two alternative developments could be built in the near future. The High Mountain Sheep project could be constructed now without being a serious hazard to the anadromous fishery, since it

would affect less than 3 percent of the fish run passing McNary Dam in addition to that already blocked by existing projects on the Middle Snake River. Since construction of either the Lower Canyon project or the Nez Perce project is precluded until the fish problem is solved, which may be as much as 15 years or more, the benefits that would be realized from the High Mountain Sheep project during the period of delay would outweigh the economic superiority of the Nez Perce project. The Division En-
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gineer recommended authorization for construction of a High Mountain Sheep project that would provide a reservoir at elevation 1490 feet above mean sea level; however, the Board of Engineers for Rivers and Harbors found that the reservoir for the High Mountain Sheep project should be about 1510 feet above mean sea level. I concur in these views of the Board, except I consider the 1510 foot elevation to be a minimum, and during detailed study and design it may be found advantageous to construct the dam to provide a reservoir pool a small amount higher than elevation 1510. The Pacific Northwest Power Company has recently applied to the Federal Power Commission for a license to construct a project at this site. If this license is granted any development at this site should be equal in scope and purpose to the project recommended in this report.

17. The logical method of approaching a solution to the difficult problem of choosing between the alternative High Mountain Sheep-Lower Canyon and the Nez Perce projects would be to defer making a choice until either a satisfactory solution has been found to the fish passage problem or the time has been reached when a start must be made on detailed design of either Nez Perce Dam or High Mountain Sheep Dam in order to meet the predicted regional power load at the time the project can put power on the line. If this course were pursued, other projects in the Major Water Plan that can be constructed

early should be undertaken before a decision is made. Should Canadian storage become available, it would serve to defer the date when a decision must be made. In the meantime, intensive research should be conducted in an endeavor to find a solution to the fishery problem, and if it is solved in time, the Nez Perce project should be built. On the other hand, if it becomes apparent that either Nez Perce or High Mountain Sheep Dam must be started in order to meet the anticipated regional power load at the time they can go on the line, and the fishery problem has not been solved, it will be necessary to start design and construction of High Mountain Sheep Dam. I have approached the problem in this manner, under two assumptions: (a) that all projects in the Major Water Plan except Libby, Penny Cliffs and Lower Canyon, but no Canadian storage, precede High Mountain Sheep or Nez Perce, and (b) that 18 million acre-feet of Canadian storage, and all projects in the Major Water Plan except Penny Cliffs and Lower Canyon, precede High Mountain Sheep or Nez Perce. Two charts are attached which show the estimated regional power loads and the two methods I have assumed of meeting them. With respect to the first assumption, Chart 1, it would be necessary to start advance engineering and detailed design in 1962 in order to meet the maximum predicted requirement for power as stated in the report of the Division Engineer, and in 1965 to meet the

[fol. 16816] Sheet 9 of 16

average prediction of load. Under the second assumption, Chart 2, these starts would have to be made in 1965 and 1968 respectively. Considering the time it takes to obtain authorization of a project, the time it might take to reach an agreement with Canada with respect to the provision of Canadian storage and the subsequent implementation of that agreement and the financing and construction of Canadian projects, and the unanimity among the several fisheries agencies that the solution of the fishery problem cannot be expected before 1968, it is obvious that with or without an agreement as to Canadian storage a decision

must be reached now as to the development of the High Mountain Sheep-Nez Perce reach of the Middle Snake. I therefore conclude that the design and construction of the High Mountain Sheep Dam should be initiated at an early date, with Lower Canyon Dam to follow if and when a solution to the fishery problem is found.

18. Although the Wenaha project on the Grand Ronde River would intercept only about 7 percent of the migratory fish runs above McNary Dam, the Board of Engineers for Rivers and Harbors believes that authorization of this project should be delayed until satisfactory fish passing facilities at high dams have been developed. I concur in the view of the Board of Engineers for Rivers and Harbors that authorization of this project should not be recommended at this time.

19. The Division Engineer recommends that navigation on the upper Columbia River be extended above the McNary project. I have given this matter intensive consideration, including a careful analysis of a report recently prepared by proponents of the extension project, which was not available to the Division Engineer at the time he prepared his report. I conclude that potential waterborne commerce and prospective transportation savings sufficient to justify improvement of the waterway to provide barge navigation from the McNary project to Rock Island Dam are not reasonably assured at this time. I concur with the Board of Engineers for Rivers and Harbors that this extension of navigation should not be authorized at this time and that further consideration should be given to the matter after the authorized improvements in the lower river have been in operation a sufficient period of time to serve as a yardstick for predicting traffic on the extension. However, nothing should be constructed in a manner which will preclude the later extension of this waterway, or to make it more costly.

20. The Asotin project recommended by the Division Engineer and the Board of Engineers for Rivers and Har-

bors for navigation and power would be economically justified by prospective power benefits alone. The navigation benefits, however, would depend almost entirely on the
[fol. 16817] Sheet 10 of 16
development, exploitation, and movement of limestone from deposits upstream from the Asotin site. At this time, the uses of limestone from this source reasonably expected to develop and the savings in transportation costs are not sufficiently assured, in my opinion, to warrant the inclusion of a lock for barge navigation. Realization of any navigation benefits from inclusion of a lock would also depend upon completion of the authorized downstream navigation facilities. Inclusion of locks in the Asotin project should, therefore, be deferred until further developments demonstrate their full economic justification. However, should the Asotin project be constructed for power only, provisions to permit the future addition of a navigation lock, if and when warranted, should be included.

21. The Paradise project on the Clark Fork River is desirable from an engineering standpoint and its development would be economically feasible. However, its construction would require extensive railroad relocations, and exorbitantly large relocation costs would be involved. The Knowles project on the Flathead River, together with other feasible and desirable projects in that basin, would develop most of the benefits that would be produced by the Paradise project at a less cost and with less disruption to facilities in the area. The Knowles project has a substantially higher benefit-cost ratio than the Paradise project and the additional cost of developing the Paradise site over the cost of developing the Knowles site cannot be justified incrementally. I therefore concur in the findings of the Board of Engineers for Rivers and Harbors that the Knowles project rather than the Paradise project should be authorized for construction.

22. The authorized Libby project is an important element in the development of the Columbia Basin resources and has been included in the Major Water Plan. Construc-

tion of the Libby project, however, is contingent upon arrangements being made satisfactory to Canada pursuant to the Boundary Waters Treaty of 1909. Any agreement with Canada for cooperative development of Canadian storage should include the Libby project or preserve the advantage to the United States that would result from its construction.

23. The Board of Engineers for Rivers and Harbors in response to specific Congressional resolutions has considered the advisability of the Omak Lake-Goose Lake pumped-storage project, and a larger lock at the Bonneville project. The Board finds that these modifications are not economically feasible at this time and I concur in those findings.

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24. The problem of passing migratory fish over high dams and the preservation of the fishery resources of the Columbia River Basin has been a concern of the Corps of Engineers for many years. Timely and orderly development of water resources projects to meet the economic needs of the basin depend on an early solution to these problems. The research programs now under way and planned by the State and Federal agencies should be continued diligently so that the results may be available as soon as possible.

25. The benefits and costs attributable to power in the report are estimated on the basis of foreseeable power requirements for 1985, assuming that all projects in the Major Water Plan have been completed and that the remainder of the load requirement will be met by new thermal plants. Because of the uncertainty of obtaining benefits from Canadian storage, no credit was taken for power that might be generated from such storage. However, should it materialize, less thermal power would be required. Full realization of power benefits will require the installation of additional generating units at downstream sites. Authority is available under existing legis-

lation, except at Bonneville Dam, for installation of additional units at authorized Corps of Engineers projects required to meet projected power requirements through 1985. Authority for additional generating units at Bonneville Dam will be requested when warranted. Development of the ultimate power potential of the Major Water Plan will require the installation of additional generating capacity. Further authorization will be requested when the need for this additional capacity develops.

26. Storage projects of the Major Water Plan would effect a large reduction in damages from major floods both in upstream flood zones and in the major damage area along the lower river. Pertinent data for the projects are shown on the tabulation included in the Division Engineer's report. The desirable immediate flood control goal, regulation of flood flow of 1894 magnitude to a peak flow of 800,000 cubic feet per second at The Dalles, will be achieved by construction of projects in the plan having a total usable storage of about 18 million acre-feet. A desirable further goal, reduction of the same flood to a flow of 600,000 cubic feet per second at The Dalles, can be accomplished by projects in the Major Water Plan having a total usable storage of about 32.4 million acre-feet. Flood control benefits used in the report of the Division Engineer appear to be considerably over-estimated; however, a reduction of these benefits would not affect the justification of projects recommended nor their relative benefit-to-cost ratios.

[fol. 16819]

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27. The new projects included as elements of the Major Water Plan would add initial at-site power facilities of about 3 million kilowatts name-plate rating. About 4 million kilowatts of average continuous power would be added to the system as a whole for the critical period and 1985 conditions. These added projects would supply about 14 percent of the estimated total regional requirements of about 200 billion kilowatt hours in 1985.

28. The reservoirs in the Major Water Plan will provide excellent and needed opportunities for recreational activities. The Major Water Plan will increase the average low water flow at The Dalles to about 138,000 cubic feet per second, an increase of about 50 percent over natural conditions. This increase in flow will result in benefits to domestic water supply, pollution abatement and fish and wildlife in addition to benefiting navigation and power. The Garden Valley project will eventually provide material direct irrigation benefits to the Payette Basin. Other storages will benefit future irrigation.

29. Additional elements are now warranted for authorization in the plan of development for the Willamette River Basin. The Division Engineer and the Board of Engineers for Rivers and Harbors find that the Cascadia and Gate Creek projects for flood control and related uses, the Strube reregulating dam and reservoir with a small power installation below the existing Cougar project, and a modification of the existing Fern Ridge Dam to increase its effectiveness for flood control are economically justified. Pertinent data for the recommended improvements are shown on the tabulation attached to the Division Engineer's report. I concur in these findings.

30. I therefore recommend:

a. That the existing authorized project for the Columbia River Basin be modified at this time to include construction of the following additional projects of the Major Water Plan, generally in accordance with the plans of the Division Engineer, except as modified herein and in the report of the Board of Engineers for Rivers and Harbors, and with such further minor modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost of $880,130,000 for construction and $4,762,000 annually for operation and maintenance in addition to that now required:

[fol. 16820]
ENGWD

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To: The Secretary of the Army

| Project | Location | Construction cost | Annual operation and maintenance |
|---|---|---|---|
| Long Meadows | Yaak River, Mont. | $ 25,709,000 | $ 134,000 |
| Flathead Lake Outlet Improvement | Flathead River, Mont. | 6,142,000 | 13,000 |
| Knowles | Flathead River, Mont. | 234,910,000 | 725,000 |
| Enaville | Coeur d'Alene R., Ida. | 78,036,000 | 252,000 |
| High Mountain Sheep | Snake River, Ida. & Ore. | 198,131,000* | 2,230,000* |
| Penny Cliffs | Middle Fork, Clearwater River, Ida. | 210,036,000 | 758,000 |
| Bruces Eddy | North Fork, Clearwater River, Ida. | 127,166,000 | 650,000 |
| Total | | $880,130,000 | $4,762,000 |

* Estimates based on pool elevation of 1510 feet above mean sea level, and the construction of an arch dam rather than a concrete gravity dam, which was estimated to cost $241,782,000 in the report of the Board of Engineers for Rivers and Harbors.

b. That the following additional projects of the Major Water Plan be authorized for construction, substantially as planned and proposed by the Bureau of Reclamation, at an estimated construction cost of $200,993,000:

| Project | Location | Construction cost | Annual operation and maintenance |
|---|---|---|---|
| Ninemile Prairie | Blackfoot River, Mont. | $ 54,893,000 | $ 297,000 |
| Garden Valley Division | Payette River, Ida. | 146,100,000 | 1,150,000 |
| Total | | $200,993,000 | $1,447,000 |

c. That the following projects be authorized as additions to the Willamette Basin plan, generally in accordance with the plans of the Division Engineer and with such minor modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost of $51,015,000 for construction and $232,600 annually for operation and maintenance in addition to that now required:

[fol. 16821] Sheet 14 of 16

ENGWD

To: The Secretary of the Army

| Project | Location | Construction cost | Annual operation and maintenance |
|---|---|---|---|
| Strube Re-regulating Reservoir | South Fork, McKenzie River, Ore. | $ 6,685,000 | $ 32,400 |
| Gate Creek | Gate Creek, Ore. | 15,920,000 | 91,200 |
| Fern Ridge (Modification of existing project) | Long Tom River, Ore. | 140,000 | 0 |
| Cascadia | South Santiam Riv., Ore. | 28,270,000 | 109,000 |
| Total | | $51,015,000 | $232,600 |

d. That the depth and width of the authorized channel in the Columbia-Snake River barge navigation project be established as 14 and 250 feet, respectively, at minimum regulated flow.

e. That each project be rejustified in a brief report to the Public Works Committees of Congress shortly before the initial appropriations for design are requested, so as to insure that they are economically justified under the conditions then existing or reasonably anticipated. The prospect of obtaining Canadian storage would be one of the factors considered at that time.

f. That research in methods of passing anadromous fish over high dams, especially downstream migrants, be continued at a high rate, and that adequate Federal appropriations be made for this purpose, and for other research in methods of improving the Columbia River fishery.

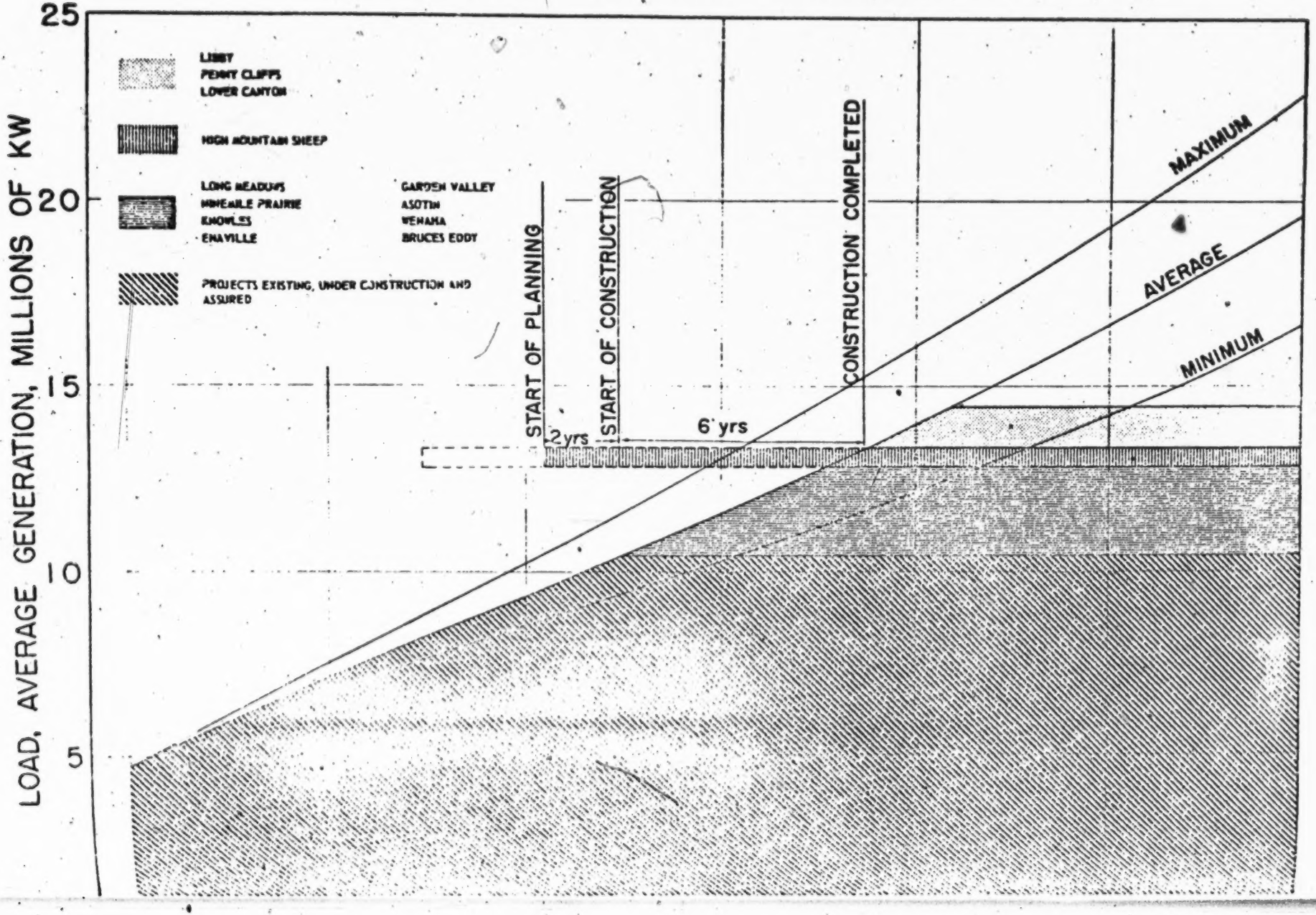
g. That this report with illustrations and appendices be reproduced as a public document to permit utilization of the data and plans by all concerned in water resources development of the Columbia River Basin.

/s/ E. C. Itschner
E. C. Itschner
Lieutenant General, USA,
Chief of Engineers

2 Incls

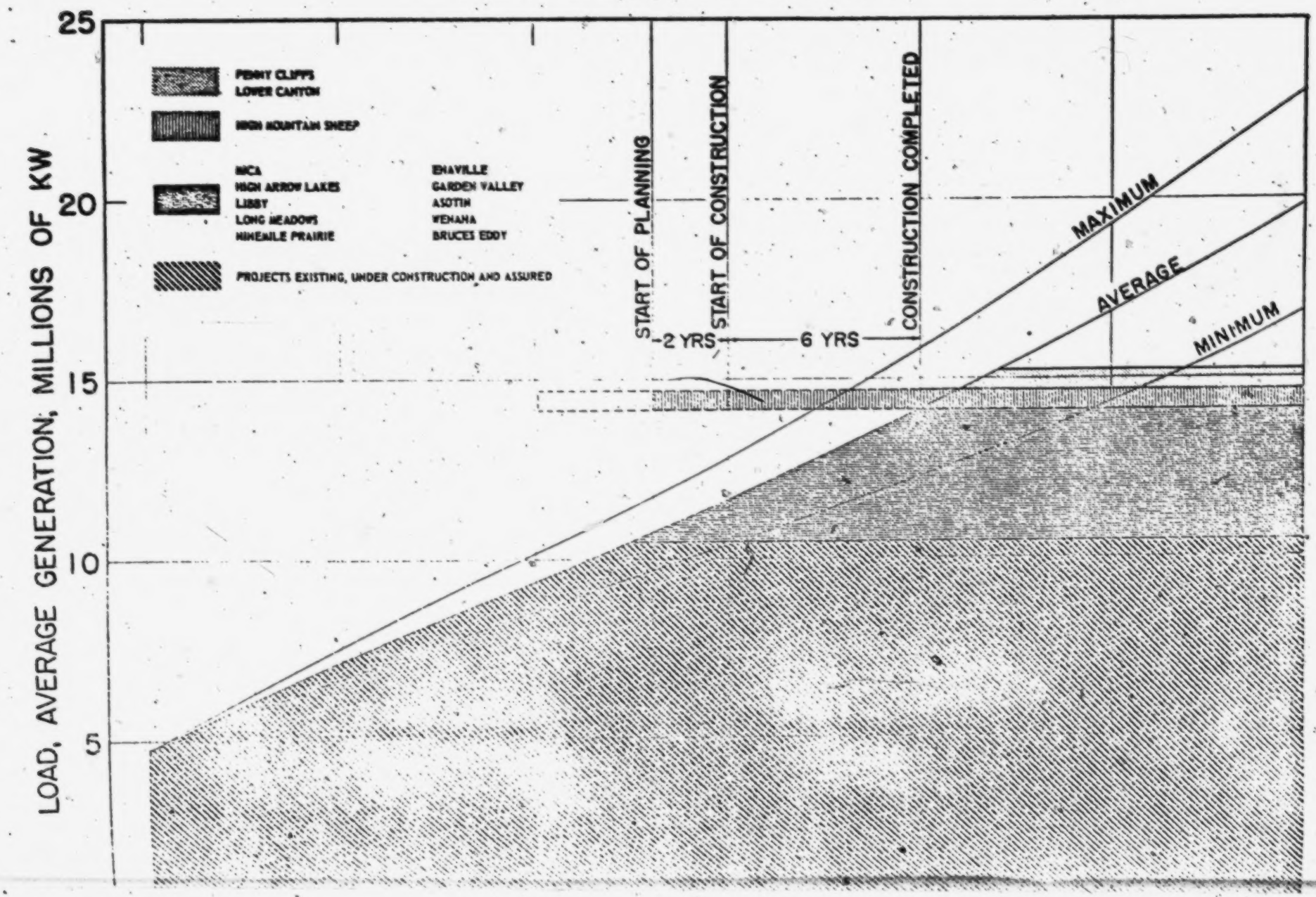
1. Chart 1
2. Chart 2

# CHART I. ASSUMED METHOD OF MEETING POWER LOADS WITHOUT CANADIAN STORAGE.



[fol. 16823]

# CHART 2 ASSUMED METHOD OF MEETING POWER LOADS WITH CANADIAN STORAGE



[fol. 16864a]

P-2243–P-2273
CHDC # 18728 & 18729
Item *C* By Referendum
Item *M* by Referendum

87th Congress, 2d Session House Document No. 403

# COLUMBIA RIVER AND TRIBUTARIES

## IN FIVE VOLUMES

## VOLUME I

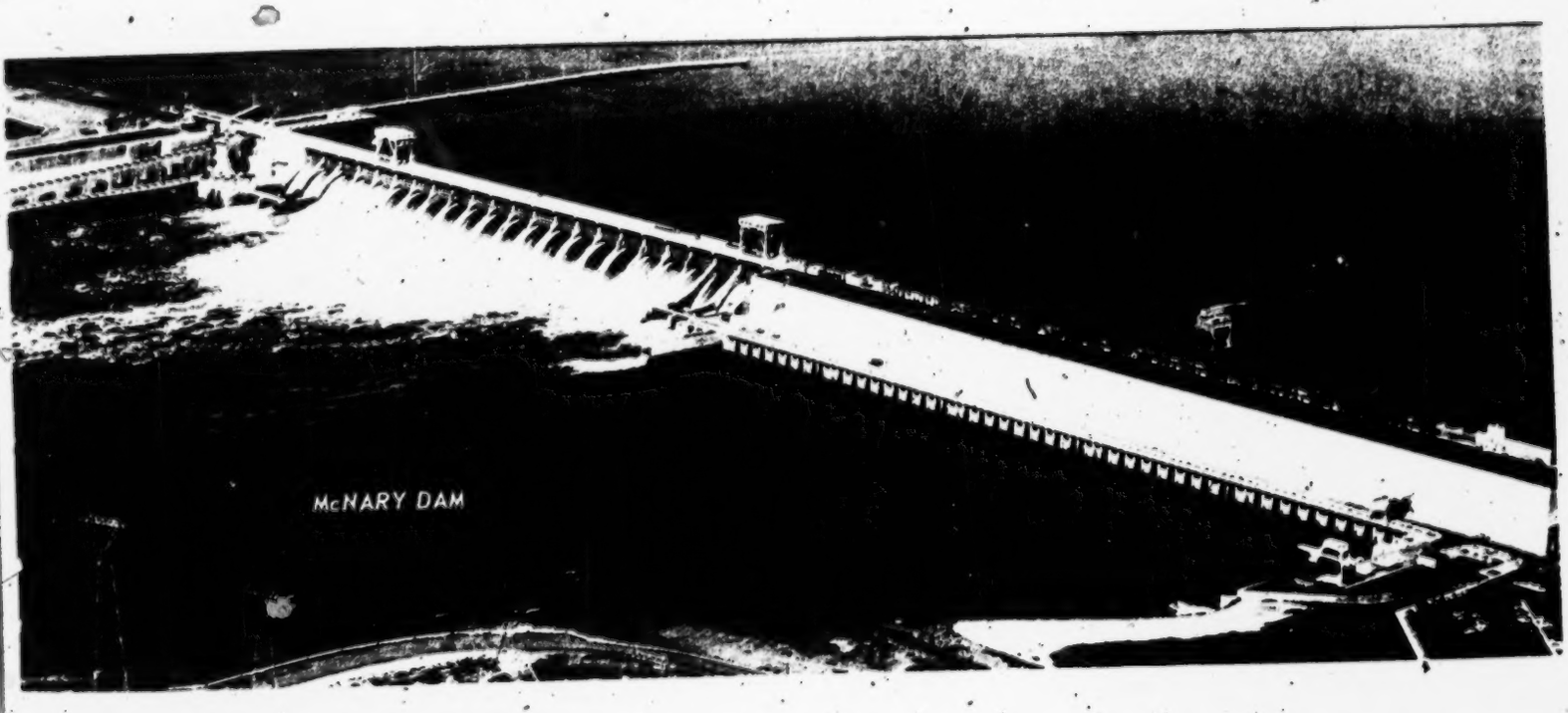
Review of H. D. 531, 81st Congress, 2nd Session

# WATER RESOURCE DEVELOPMENT OF THE COLUMBIA RIVER BASIN · VOL. I

A REPORT BY THE DIVISION ENGINEER, U. S. ARMY ENGINEER DIVISION, NORTH PACIFIC, TO THE CHIEF OF ENGINEERS, UNITED STATES ARMY

JUNE, 1958

[fol. 16865]



# Freedom Project

## SALMON RIVER

The Freedom project is a potential project for possible future development.

### GENERAL DESCRIPTION

Freedom dam site is located on Salmon River at mile 69.3, about 17 miles downstream from Riggins and 3 miles above White Bird, Idaho. This project, which would be located next downstream from the Crevice project, would be primarily a head development for power production with only enough storage to reregulate releases from Crevice and to control inflow below that location. Normal pool would be at elevation 1780 and the initial power installation would be 180,000 kw. The project was considered in House Document 531, 81st Congress, 2d Session, and was listed therein as a potential project. The location and layout of the project are shown on Plates 73 and 74, Appendix E.

### HYDROLOGY

Drainage area tributary to the site is 13,320 square miles. Mean annual runoff for the 46-year period, 1910-1945, was 7,800,000 acre-feet. Maximum and minimum annual runoffs were 11,480,000 acre-feet in 1943 and 4,200,000 acre-feet in 1931. The mean discharge of the stream at the site is 10,700 cfs. The maximum known discharge occurred during the 1894 flood and is estimated to be 120,000 cfs. The maximum probable flood peak estimated for the location is 246,000 cfs and this discharge has been used for spillway design.

### DAM SITE

The river at the site is about 170 feet wide at low water elevation 1558 and occupies the entire canyon floor between the highway and the left canyon wall. Both abutments slope steeply to elevations well above the top of the contemplated dam. Rock is exposed over the major portion of the site area and on the basis of surficial examination appears to be fresh and sound. No drilling has been accomplished. The river channel is relatively deep due to the constriction at the site and probably contains some gravel.

### PROJECT LAYOUT

A concrete gravity dam with a spillway located near the left river bank is proposed. The dam would have a maximum height of 300 feet from foundation to crest. Spillway control would be by three 50- by 50-foot radial gates with a combined capacity of 246,000 cfs at normal pool level. These gates would extend a sufficient distance below minimum pool level to provide an outlet release of 60,000 cfs for flood regulation operations, the same as that provided at Crevice.

The initial power installation would consist of two units rated at 90,000 kw, for a total capacity of 180,000 kw. Under ultimate

*Salmon River at Freedom Dam Site. The axis is at extreme top of picture.*



[fol. 16866]

conditions three similar units would be added for a total project capacity of 450,000 kw. The powerhouse would be on the right bank of the river immediately downstream from the dam and parallel to the river's flow. Water would be supplied to the turbines through tunnels and penstocks originating in trashrack structures on the upstream face of the concrete dam. Initial project construction for the future units would consist of intake structures on the upstream face of the dam, penstocks through the dam and excavation for the penstock tunnels and future powerhouse structure. With normal pool at elevation 1780, as limited by the town of Riggins upstream, and tailwater at elevation 1575 (normal pool elevation of Lower Canyon), gross head would be 205 feet.

### RESERVOIR DESCRIPTION

At normal pool elevation 1780, Freedom Reservoir would extend 24 miles up Salmon River to a point 7 miles beyond Riggins, Idaho. The elevation has been limited to 1780 in order not to cause major disruption to the town of Riggins. Gross capacity at this elevation would be 285,000 acre-feet, and with a 10-foot drawdown, 24,000 acre-feet of pondage would be available for stream regulation and power operation. Surface area of the reservoir at maximum pool would be 2,900 acres. Lands that would be inundated are primarily used for grazing. Improvements within the area affected by the project consist of some ranch developments and a limited number of commercial and residential structures. Total land required for flowage and work areas, including necessary lands for public access and recreation, is estimated to be about 2,800 acres. Allowance has been made in the reservoir estimate for acquiring existing mineral rights.

### RELOCATIONS

Approximately 18.2 miles of U. S. Highway 95, 8.2 miles of county roads and 3 miles of Forest Service roads would require relocation. Although almost no national forest land would be inundated by the reservoir, access to forest lands would be affected by the flooding of roads. The proposed road relocations as summarized above would minimize adverse effects on Forest Service activities.

### RECREATION

The National Park Service estimates increased recreational use of 8,500 visitor-days upon completion of the project. Facilities recommended by the Park Service and included in the project estimate consist of 30 picnic and camp units, one boat launching ramp, three boat docks, and access roads. In addition, facilities for accommodation of visitors at the dam are included as a part of basic project requirements.

### FISH AND WILDLIFE

The Salmon River in this reach is utilized by anadromous fish as a migratory route to or from their spawning areas farther upstream. Extensive facilities for both upstream and downstream migrants would be required. During the project construction period, the fish would be trapped and transported around the construction activities. After project completion, upstream fish migrants could be collected at the powerhouse and conveyed to the reservoir by means of ladders or fish locks in the dam. The cost of a bank of skimmer devices on each side of the power intakes, for the collection and passing of downstream migrants has been included in the estimate. Based on limited information, it is believed that little spawning takes place in the reservoir area.

A few big game animals inhabit the area, and although the project should not significantly affect this resource, purchase of 1,000 acres of compensatory habitat for waterfowl and big game is included in the fish and wildlife estimate.

### PROJECT COSTS

Construction cost of the Freedom project is estimated to be $66,550,000 with the initial power installation of two units. An additional cost of $20,650,000 would be incurred for the ultimate power installation. A period of 3 years would be required for initial construction. Project and annual costs for the initial project are summarized in the tabulation on the following page.



[fol. 16867]

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Construction Costs

| Feature | Estimated Cost |
|---|---|
| Lands and damages | $ 300,000 |
| Relocations | 12,280,000 |
| Reservoir | 70,000 |
| Dam | 17,900,000 |
| Fish and wildlife | 5,900,000 |
| Powerplant | 16,590,000 |
| Recreation | 50,000 |
| Buildings, grounds and utilities | 800,000 |
| Permanent operating equipment | 330,000 |
| Construction facilities | 5,880,000 |
| Engineering and design | 2,390,000 |
| Supervision and administration | 4,060,000 |
| Construction cost | $66,550,000 |
| Interest during construction | 2,496,000 |
| Investment cost | $69,046,000 |

Annual Costs

| | | |
|---|---|---|
| Interest and amortization | | $ 2,435,000 |
| Operation, maintenance and replacements: | | 714,000 |
| Power | $450,000 | |
| Dam and reservoir | 120,000 | |
| Recreation | 4,000 | |
| Buildings and grounds | 30,000 | |
| Fish facilities | 110,000 | |
| Total Annual Costs | | $ 3,149,000 |

*PROJECT ACCOMPLISHMENTS*

The Freedom project would be a justifiable addition to any of the four alternative plans for development of the Middle Snake River not involving Salmon River diversion. The Crevice storage project which would provide the required river regulation for the Freedom run-of-river project could be added to each of the four alternative plans. The alternative plans are described in Chapter VIII.

Evaluation of the Freedom project in a plan with Crevice and Lower Canyon indicates that power benefits, equivalent to thermal power savings, would be about $4,500,000 annually. Other benefits would result from recreational use of the project. These benefits are estimated to be approximately $14,000 annually.

*ECONOMIC COMPARISON*

Total accomplishments creditable to the project are $4,514,000. Comparison with annual costs of $3,149,000 indicates that the project has a justification ratio of 1.43.

*VIEWS OF INTERESTED AGENCIES AND PARTIES*

This project has not been presented at hearings before the public. The Fish and Wildlife Service opposes the project because of its potentially damaging effects on runs of anadromous fish in the Salmon River.

[fol. 16868]

# China Gardens Project

## SNAKE RIVER

The China Gardens project is a potential project for possible future development.

*GENERAL DESCRIPTION*

The China Gardens site is located on Snake River, mile 172.5, about 3.5 miles above the mouth of Grande Ronde River and about the same distance below the Oregon-Washington State line. The primary purposes of a project at this site would be to complete the power head development between the downstream Asotin project and the immediately upstream project and to provide for regulation of upstream peak power releases. As such, the China Gardens project, modified as conditions of upstream development require, could form an integral part of several alternative plans of development of the water resources of the Middle Snake River.

# Middle Snake River Basin

## CHARACTER OF THE BASIN

The Middle Snake River area, as considered in this report, extends from Weiser, Idaho, downstream to Lewiston, Idaho, and includes the Burnt, Powder, Imnaha, Salmon and Grande Ronde River Basins as well as minor tributaries, draining portions of Idaho, Oregon, and Washington. With the exclusion of Grande Ronde Basin, which is discussed separately in this chapter and will not be considered further in this section, the area of the subbasin is about 19,500 square miles or slightly over 8 percent of the Columbia River drainage above The Dalles. Combined with the Upper Snake River Basin above Weiser, the watershed has an area of some 89,500 square miles or about 38 percent of the Columbia River drainage above The Dalles. The contributions of these areas to runoff at The Dalles are about 9,300,000 and 22,800,000 acre-feet or 7 and 17 percent, respectively. Comparative data for various streams in the subbasin are given in the following tabulation:

| Stream | Drainage Area (Sq. Mi.) | Average Annual Runoff (Acre-Feet) | Acre-Feet per Sq. Mi. Average |
|---|---|---|---|
| Powder River | 1,710 | 396,000 | 230 |
| Imnaha River | 950 | 390,000 | 410 |
| Salmon River | 14,100 | 8,100,000 | 575 |
| Middle Snake River (excluding Grande Ronde) | 19,500 | 9,300,000 | 480 |
| Upper Snake River | 70,000 | 13,500,000 | 190 |
| Columbia River at The Dalles | 237,000 | 133,700,000 | 564 |

The Middle Snake area is notable for the general ruggedness of its terrain. In most instances the drainage system is entrenched in deep canyons and particularly in the 100-mile reach commonly referred to as Hells Canyon. The elevations in the subbasin vary from 715 feet above sea level at Lewiston to nearly 12,000 feet in the headwaters of Salmon River in central Idaho.

## RESOURCE DEVELOPMENT

The Burnt and Powder River Basins will be included in a separate report on upper Snake River and tributaries and since opportunities are not available on these lesser streams for projects which would function in an over-all basin plan, the Burnt and Powder Rivers will not be discussed further.

The Middle Snake area offers excellent opportunities for water resource development. Attractive dam sites are to be found at many locations and a large supply of water is available but until recent years development has been negligible. The principal use of water in the past has been to irrigate over 100,000 acres in the upper valleys and along some of the tributaries of Salmon River, generally by direct diversion and without construction of any significant storage.

The main economic activities in the Middle Snake area have centered around lumbering, mining, and agriculture, although recreational use of the vast unpopulated areas is increasing rapidly. The first steps toward development of the water resource potential have been taken only recently. In 1955, the Idaho Power Company was licensed by the Federal Power Commission to construct a series of three power dams along Snake River in the upper reaches of the subbasin. The Brownlee project, uppermost of the group, is nearly completed and the Oxbow Dam is under construction. The third of these licensed projects, the low head Hells Canyon project, is scheduled to follow in the near future. Altogether, these projects will develop a total head of about 600 feet and nearly 900,000 kw of power. In addition, Brownlee will have 1,000,000 acre-feet of storage usable for downstream flood control and power generation.

Comparative runoff data clearly indicate the effects of present regulation on the upper Snake River. Average discharges for the 7 low water months, September through March, expressed as percentages of the average annual discharges, are 25 percent for the Salmon River and 61 percent for the Snake River above the mouth of the Salmon River.

## VALUE OF FURTHER RESOURCE DEVELOPMENT

The contribution of the Middle Snake area to lower Columbia River flood flows amounts to about 9 percent for the Salmon River and 7 percent for the Snake River above the Salmon River. On the basis of rational distribution of required storage for control of the 1894 flood to 600,000 cfs at The Dalles, a total of 3,200,000 acre-feet of usable storage has been assigned to the Salmon River and 2,400,000



[fol. 16869]

acre-feet to the Snake River. In consideration of the characteristics of these two rivers and present developments, storage control on the Salmon River would be particularly desirable.

The availability of high heads and good flows makes the Middle Snake River area unusually attractive for power generation.

The creation of slack water conditions, particularly in the lower reaches, would benefit commerce by permitting navigation beyond present authorized limits. Improved accessibility by water transport would also result in enhancement of the region's recreation values.

## RESERVOIR LOCATION PROBLEMS

The area has a number of very attractive dam sites but the narrow canyons which offer these sites also necessitate the construction of high dams to gain adequate storage and result in large fluctuations of head during operation.

Along the lower reaches of the Middle Snake River between Lewiston and the Grande Ronde River, development of the stream would be limited to run-of-river power and navigation structures primarily because of valley development in the Lewiston-Clarkston-Asotin area.

The Imnaha River Basin is not well suited to storage development because of the limited control which could be achieved.

Storage in the headwaters and tributaries of Salmon River above the Middle Fork would involve extensive flowage problems. The middle Salmon River area, roughly that reach from the vicinity of the Middle Fork to about the South Fork, lies in the dedicated Idaho Primitive Area and the Selway-Bitterroot Wilderness Area, regions which are valued for their natural wilderness condition, the abundance of game animals, and the excellent spawning grounds for anadromous fish.

A major problem involved in any proposal for the Middle Snake area is the maintenance of the fishery resource. The Salmon River in particular contains some of the most important fish spawning areas in the Columbia Basin.

## ALTERNATIVE PLANS

In selecting a plan of development for adoption as a part of the Major Water Plan, the Middle Snake area can be analyzed in two parts: that portion below the mouth of Grande Ronde River where large storage developments are not feasible, and the larger area above Grande Ronde River. The lower reach involved no particular problems or alternatives and a plan of development by dams of moderate height was selected as will be described subsequently.

The Middle Snake Basin above the Grande Ronde River offers many possibilities for development. A total of six alternative plans were established and evaluated on a comparable basis to determine their relative economic merits. Since the Crevice storage project would inundate an appreciable section of the Selway-Bitterroot Wilderness Area, as noted in Chapter VII, the Crevice project was not included for consideration as an element of the Major Water Plan and for that reason has been omitted in these comparisons. The Freedom run-of-river project has also been omitted since it would not be economically feasible without upstream regulation such as provided by Crevice storage. Studies indicate that the Crevice project, and also the Freedom project where Salmon River diversion is not involved, would be well justified as future increments to the alternative plans.

Figure 19 illustrates the principal feature of the six plans studied. Physical data on the various projects included in one or more of the alternative plans are presented in Table 44.



[fol. 16870]

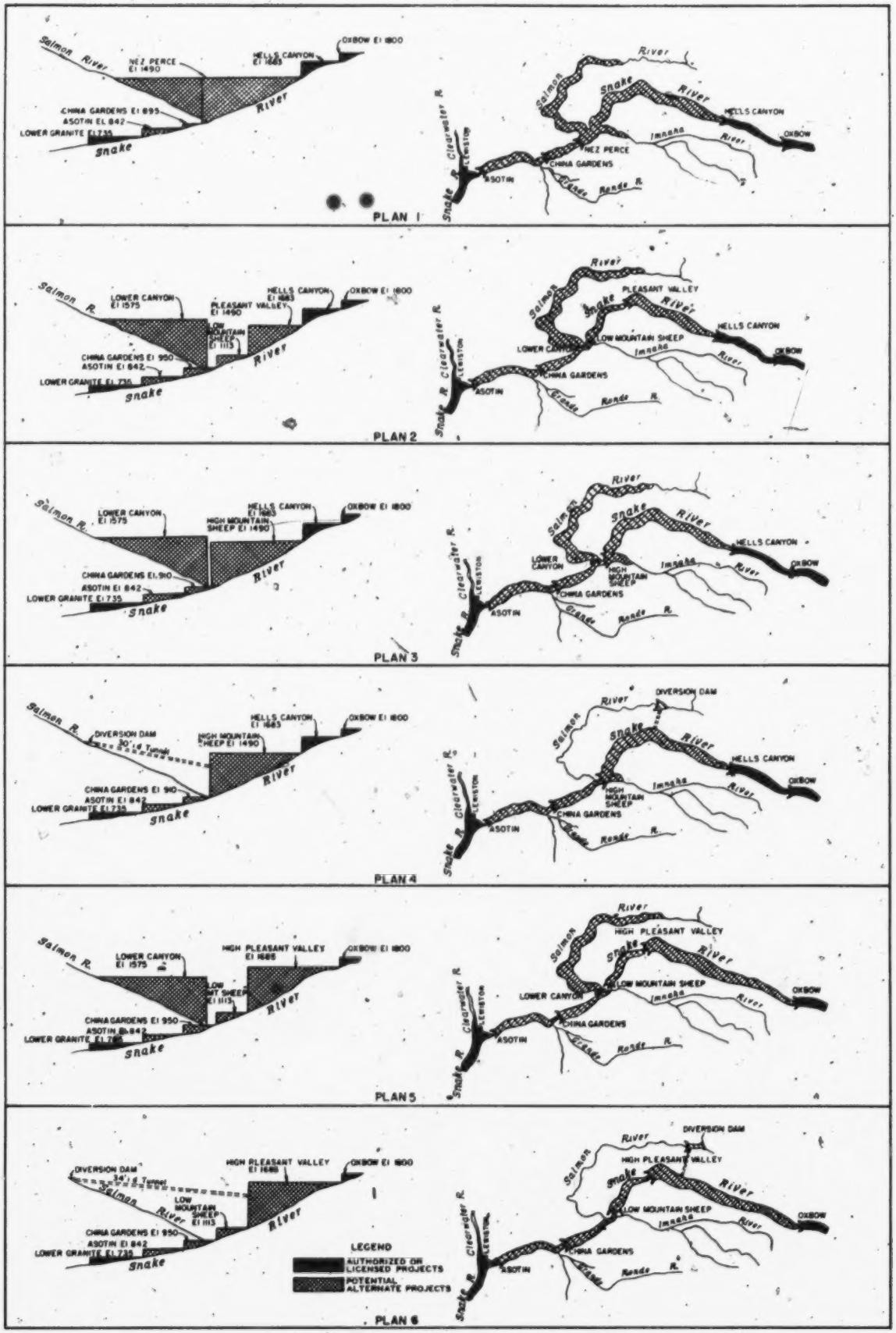



FIGURE 19 ALTERNATIVE PLANS FOR MIDDLE SNAKE RIVER



[fol. 16871]

TABLE 44

## ALTERNATIVE MIDDLE SNAKE PLANS

| Project | Pool Elev (Ft) | Gross Head 1/ (Ft) | Total Available Storage (1000 Ac.-Ft.) | Init. Inst. Capacity (1000 kw) | Plan No. (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|---|---|---|
| China Gardens (future) | 895 | 52.5 | – | 150 | X | | | | | |
| " " " | 910 | 67.5 | – | 180 | | | X | X | | |
| " " " | 950 | 107.5 | – | 240 | | X | | | X | X |
| Nez Perce | 1,490 | 595 | 4,500 2/ | 1,200 | X | | | | | |
| Low Mt. Sheep | 1,113 | 163 | | 282 | | X | | | X | X |
| High Mt. Sheep | 1,490 | 580 | 2,100 | 600 6/<br>750 7/ | | | X | X | | |
| Low Pleasant Valley | 1,490 | 379 | 500 | 576 | | X | | | | |
| High Pleasant Valley | 1,685 | 572 | 1,300 4/<br>2,047 7/ | 728 5/6/7/ | | | | | X | X |
| Lower Canyon | 1,575 | 625 8/<br>665 9/ | 2,500 3/ | 640 | | X | X | | X | |
| Salmon-Snake Diversion – 8 mile, 30 ft. dia. tunnel | | | | | | | | X | | |
| Salmon-Snake Diversion – 12 mile, 34 ft. dia. tunnel | | | | | | | | | | X |
| Freedom (future) | 1,780 | | | 180 | X | X | X | | X | |
| Crevice " | 2,570 | | 2,300 | 435 | X | X | X | X | X | X |

*1/ Normal pool elevation to average tailwater.*

*2/ Future operation with Crevice would reduce usable storage to 2,500,000 Ac.-Ft.*

*3/ Future operation with Crevice would reduce usable storage to 1,800,000 Ac.-Ft.*

*4/ Storage with dependable capacity, as reported by U. S. Bureau of Reclamation in Special Report dated Oct. 1956, (Diversion from Salmon River not included). 2,047,000 Ac.-Ft. also were reported available for critical year power. This amount of storage was assumed available for flood control use with diversion from Salmon River.*

*5/ Incremental – USBR project less Idaho Power Company Hells Canyon project installation (1,000,000 kw – – 272,000 kw).*

*6/ Without Salmon-Snake Diversion.*

*7/ With Salmon-Snake Diversion.*

*8/ In Plans 2 & 5 with China Gardens at Elev. 950.*

*9/ In Plan 3 with China Gardens at Elev. 910.*



[fol. 16872]

## COMPARISON OF ALTERNATIVE MIDDLE SNAKE PLANS

The six alternative plans for development of the Middle Snake River, based on initial development and not including the future Crevice and Freedom projects are compared in Table 45. A China Gardens project has been included to lend equality in the comparisons because its magnitude is varied to fit the different plans. This run-of-river project develops the head between the Asotin Dam and the next upstream project in each plan. China Gardens is a potential power project for future construction and is not an element of the Major Water Plan.

A summary of Table 45 reveals that Plan 1 with the Nez Perce project has the best comparative justification ratio. Plans 2, 3 and 4 have comparable justification ratios but Plan 3 provides the greatest resource development, and the increased cost over Plans 2 and 4 is justifiable by a wide margin. Plans 5 and 6 have the lowest comparative justification ratios. These plans would conflict with the Low Hells Canyon project, licensed for construction by the Federal Power Commission.

The Nez Perce Dam, being located on the Snake River below the confluence of the Salmon and Imnaha Rivers would affect about 40 percent of the anadromous fishery resource above McNary Dam. In the absence of well established methods for successful passage of downstream migrants past high dams, the immediate construction of Nez Perce would be hazardous

TABLE 45

### ECONOMIC COMPARISON, ALTERNATIVE MIDDLE SNAKE PLANS

| | Plan | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 1/ | 6 1/ |
| Total available storage (1000 Ac.-Ft) | 4,500 | 3,000 | 4,600 | 2,100 | 3,800 | 2,047 |
| Total usable flood control storage 2/ (1000 Ac.-Ft) | 4,500 | 3,000 | 4,050 | 2,100 | 3,680 | 2,047 |
| % of eff. storage at The Dalles 2/ | 23.1 | 16.7 | 21.1 | 11.6 | 19.4 | 9.6 |
| Total est. flood control benefits 2/ ($1,000) | 5,900 | 4,140 | 5,269 | 2,898 | 4,830 | 2,404 |
| Total est. flood control benefits 3/ ($1,000) | 513 | 342 | 513 | 240 | 426 | 234 |
| Total initial power installation (1000 kw) | 1,350 | 1,738 | 1,420 | 930 | 1,890 | 1,250 |
| Total est. power values ($1,000) | 41,793 | 42,003 | 43,675 | 33,130 | 41,725 | 31,937 |
| Total est. other benefits ($1,000) | 128 | 104 | 104 | 29 | 104 | 29 |
| Total annual accomplishments 2/ ($1,000) | 47,821 | 46,247 | 49,048 | 36,057 | 46,659 | 34,370 |
| Total annual accomplishments 3/ ($1,000) | 42,434 | 42,449 | 44,292 | 33,399 | 42,255 | 32,200 |
| Total annual costs ($1,000) | 16,545 | 22,714 | 22,968 | 17,090 | 26,500 | 22,034 |
| Comparative justification ratio 2/ | 2.9 | 2.0 | 2.1 | 2.1 | 1.8 | 1.6 |
| Comparative justification ratio 3/ | 2.6 | 1.9 | 1.9 | 2.0 | 1.6 | 1.5 |

*1/ All data for Plans 5 and 6 include only incremental amounts for the High Pleasant Valley project (USBR plan) less Idaho Power Company Hells Canyon.*

*2/ Assuming inclusion in system controlling 1894 flood to 800,000 c/s at The Dalles.*

*3/ Assuming Middle Snake development delayed until after control to 800,000 c/s achieved by other projects.*



[fol. 16873]

from the standpoint of maintaining this portion of the Columbia River anadromous fishery as well as the large sports fishery of the upper Salmon River Basin. Delay in the construction of Nez Perce therefore would be desirable to permit firmer establishment of means for the adequate handling of fish.

In Plan 3, the High Mountain Sheep project which would be located below the Imnaha River would intercept fish runs normally entering this stream as well as those which would pass on up the Snake River. A much smaller portion of the resource value would be affected by the High Mountain Sheep project and the use of available provisional methods of fish passage would involve only a small risk. The Lower Canyon project lying in Salmon River just above its mouth, however, would intercept the Salmon River runs and delay in its construction would parallel that required for Nez Perce.

The only plan involving no added fish problem over that already involved in the passing of Snake River fish over the licensed Hells Canyon, Oxbow, and Brownlee projects would be Plan 6, which includes a High Pleasant Valley project combined with diversion from the Salmon River. This plan has the lowest comparative justification ratio and would provide the least increase in water resource development of the six alternative plans.

### COMPARISON OF PLANS 1, 2 AND 3 WITH TIME EQUATION

Reanalysis of the economic merit of Plans 1, 2 and 3 to include in the equation some recognition of the probable extended delay in the construction of projects affecting the Salmon River is considered necessary. Ten years is considered a minimum period for necessary active research, experimentation, and observation to determine whether satisfactory means can be developed for the handling of fish at high dams, and in order to establish sufficient statistical information to remove active objection to project construction a period of as long as 15 years might be involved. On this basis, clearance to proceed on major resource development on the Salmon River might be expected about 1970.

Adoption of Plan 1, with deferment in initiation of Nez Perce until 1970, and allowing minimum time for authorization, planning and construction, would place the completion of the project around 1980. In the interim it

*Artist's conception of the proposed Asotin Project.*

may be assumed that a steam installation of 880,000 kw would be provided to offset the absence of Nez Perce power. In Plans 2 and 3, Snake River developments could precede the Lower Canyon project on Salmon River. Delay of the Lower Canyon project would parallel that required for Nez Perce and in the absence of Lower Canyon a steam installation of about 360,000 kw would be required to carry the load.

On the basis of load projections and resource supply as depicted in Figure 20, it is entirely possible that thermal power replacement would be required for about 10 years in advance of power from the Nez Perce or Lower Canyon projects. Table 46 compares the equivalent annual accomplishment values and the equivalent annual costs for comparable 50-year economic periods for Plans 1, 2 and 3, based on a 10-year delay in elements affecting the Salmon River (Nez Perce and Lower Canyon) over the other Middle Snake elements in each plan. Since it is highly improbable that the Salmon River elements would be completed in time to participate in meeting the basic flood control plan of control to 800,000 cfs, the lesser benefits creditable to control to 600,000 cfs have been applied to these projects. For the other storage elements, Pleasant Valley and High Mountain Sheep, the accomplishment-cost comparisons have been made on both assumptions.

On the basis of the above time equated analysis, Plans 1, 2 and 3 show practically identical economic feasibility. Plan 3 would provide the greater resource development at a justifiable additional cost and therefore have a greater economic worth. Plan 2 may be eliminated as of lesser economic worth regardless of the extent of deferment included in a com-

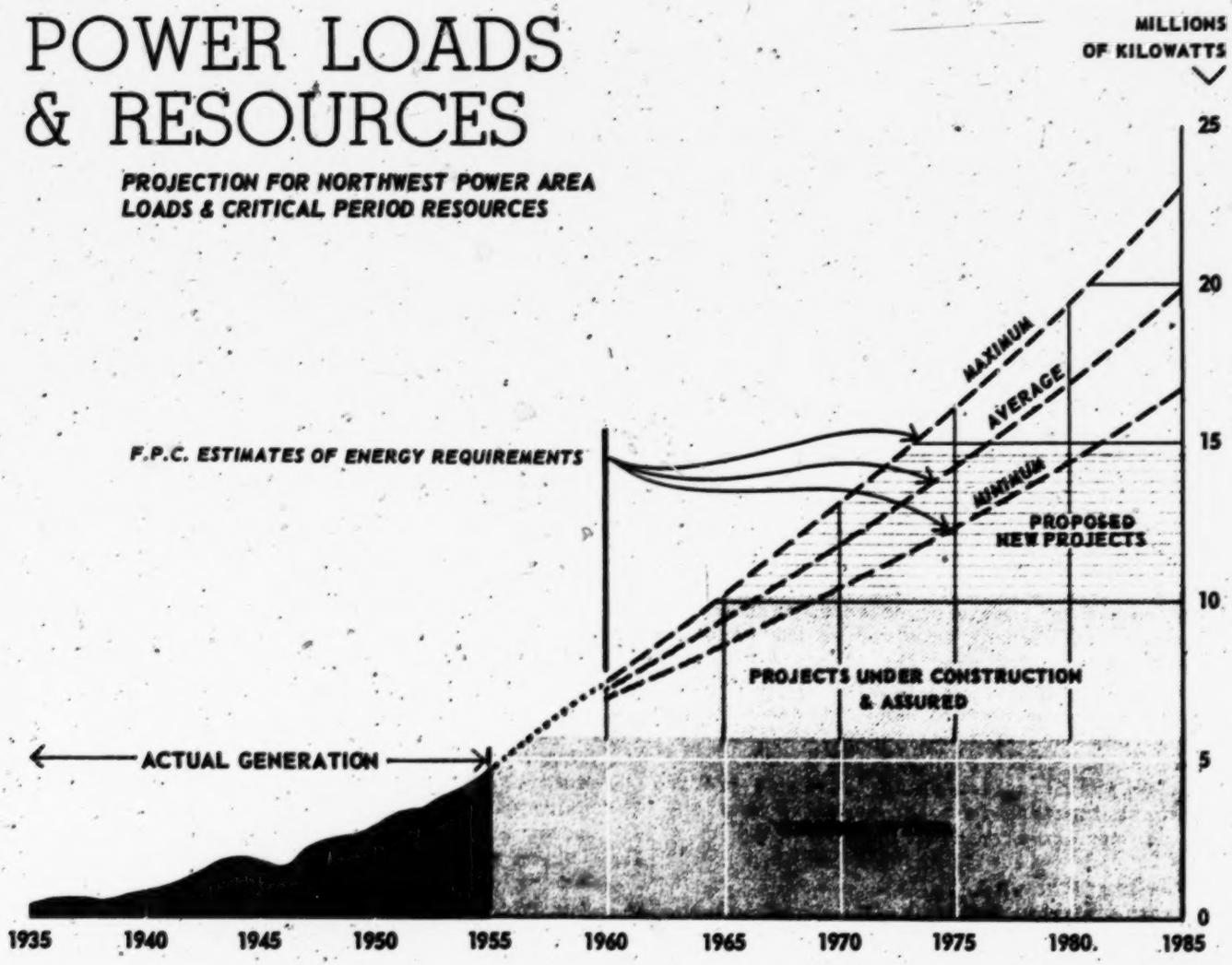


[fol. 16874]

16875

Fig. 20

# POWER LOADS & RESOURCES




parative evaluation. The economic worth of Plan 1 increases more rapidly than that for Plan 3 as the extent of deferment is decreased for the Nez Perce and Lower Canyon projects. Assuming the High Mountain Sheep project could be constructed as a part of the basic plan, a delay of seven years or less would indicate a greater economic worth for Plan 1.

In Plan 3, the Nez Perce project of Plan 1 is replaced by two dams controlling the same drainage area and in fact the contiguous abutments of these two dams are less than 1 mile apart. Separation of the Nez Perce development into two parts, Lower Canyon and High Mountain Sheep, as in Plan 3, offers the opportunity for increasing the magnitude of the development on the Salmon River without encroaching on that part of the Snake River to be occupied by licensed projects. The elevation of the Lower Canyon Reservoir is 85 feet higher than the pool of Nez Perce and therefore the production of power from Plan 3 is somewhat greater than in Plan 1. Plan 3 permits development of this resource in two stages. The High Mountain Sheep in its location on the Snake immediately above the confluence of the Snake and Salmon Rivers will require facilities for maintaining migrating fish runs on the Snake and the Imnaha Rivers. Runs on these tributaries, as evidenced by counts summarized in Figure 17 of Chapter V, are relatively small compared to the Salmon River. The Brownlee project of the Idaho Power Company has intercepted the natural



[fol. 16875]

TABLE 46

## MIDDLE SNAKE PLAN COMPARISONS

### Salmon River Elements Deferred Ten Years

| | Total Equivalent Annual Values | | Comparative Plan Justification Ratio |
|---|---|---|---|
| | Accomplishments ($1,000) | Costs ($1,000) | |
| Plan 1 | 42,500 | 24,400 | 1.7 |
| Plan 2 | | | |
| W/early Snake R. f.c. benefits | 43,000 | 24,900 | 1.7 |
| W/late Snake R. f.c. benefits | 42,400 | 24,900 | 1.7 |
| Plan 3 | | | |
| W/early Snake R. f.c. benefits | 45,300 | 25,200 | 1.8 |
| W/late Snake R. f.c. benefits | 43,700 | 25,200 | 1.7 |

movement of fish runs in the Snake and collection and transportation systems in both an upstream and downstream direction have been provided for passage at Brownlee Dam. Runs on the Imnaha are of somewhat smaller magnitude than runs in the Snake above the Imnaha and constitute only about 2.7 percent of the runs passing McNary Dam. In view of the limited magnitude involved, little risk to the regional fishery resource is foreseen in the construction of the High Mountain Sheep project using fish handling principles now in practice.

In the event an acceptable solution cannot be found for the passage of fish over the Lower Canyon Dam, diversion from the Salmon River, as in Plan 4, could be constructed in lieu of the Lower Canyon project. With a diversion structure of less than 50 feet in effective height, little hazard to the Salmon River fishery would be involved. Although representing a lesser development of the resource, Plan 4 is fully justifiable and could be adopted at a later date without loss of capital investment. The incremental cost of adding diversion to the previously completed High Mountain Sheep would also be justifiable by the additional power and flood control benefits that would be obtained.

Because of the larger resource potential that can be developed by adoption of Plan 3, the possibility of two-stage development permitting early attainment of nearly 60 percent of the benefits and the availability of a sound alternative in the event completion of the plan is not found practicable, it is proposed that Plan 3, including the High Mountain Sheep and Lower Canyon projects, be adopted in the Middle Snake River area for the Major Water Plan. However, because of the need for further development and testing of fish handling facilities for high dams and the importance of the Salmon River anadromous fishery to the region, construction of the Lower Canyon project should be deferred until an adequate handling procedure has been proven.

### *PLAN OF DEVELOPMENT*

The general plan of development for the lower part of the basin consists of a project at Asotin and the project at China Gardens included in the six alternative plans; but the only one included in the Major Water Plan at present is the project at Asotin. This project would be located on Snake River at the upstream limits of the town of Asotin. The dam is proposed to be a concrete structure with an effective height of 107.5 feet and a length of 2,900 feet. The reservoir would extend about 26 miles upstream and have only a minor amount of pondage for power purposes. The powerplant for the project would have an initial installed capacity of 288,000 kw. Other features of the project would include a navigation lock and adequate fish passing facilities. The estimated cost of the project is $125,720,000. Benefits would be derived from power, navigation, and recreation.

The proposed plan of development included in the Major Water Plan for the area above Grande Ronde River consists of two projects: High Mountain Sheep on Snake River and Lower Canyon on Salmon River.



[fol 16876]

16877 - 16878

The High Mountain Sheep project would be located on Snake River about one-half mile above the mouth of Salmon River. A concrete gravity type dam 580 feet in effective height and 1,800 feet in length would impound a reservoir containing a total storage of 3,240,000 acre-feet, of which 2,100,000 acre-feet would be usable for power and flood control. A powerplant with an initial installed capacity of 600,000 kw and facilities for passing migrating fish would be included in the project. The cost of the project under initial development conditions as outlined in Chapter VII is estimated to be $226,380,000.

The Lower Canyon project would be located on Salmon River about one-half mile above its mouth. The dam would be a rockfill structure 665 feet in effective height extending 2,200 feet across the canyon. Total storage capacity would be 3,700,000 acre-feet, of which 2,500,000 acre-feet would be usable for power and flood control. A powerplant at the project would have an initial installed capacity of 640,000 kw and adequate fish passing facilities would be provided. The estimated cost of the initial development of the project as outlined in Chapter VII is $194,550,000.

*Artist's conception of the proposed High Mountain Sheep Project.*



[fol. 16877-8]

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# Summary of Major Water Plan

In summary, the Major Water Plan for the Columbia River Basin, consisting of the group of proposed projects as discussed in the separate basin analyses, together with the projects completed, under construction, and reasonably assured, will provide a plan for optimum use of the available water resources of the Columbia River. In addition, there are a number of potential projects which may be regarded as future elements of the plan.

## EXISTING PROJECTS

The projects forming a part of the Major Water Plan which are in operation or under construction, or which are immediately prospective, are summarized in Table 47, not including the independent resources. In addition to the dam and reservoir projects, the Major Water Plan includes the authorized Columbia-Snake River slack water navigation project for which minor modification is proposed. The plan also includes the lower Columbia River levees and the extension and improvements to the levee system which have been authorized.

TABLE 47

**EXISTING OR PRESENTLY ASSURED COMPONENTS OF THE MAJOR WATER PLAN**

**Projects in Operation, Under Construction or Immediately Prospective**

| Project | Stream | Total Avail. Storage (Acre-Feet) | Installed Capacity 1/ (kw) | Status |
|---|---|---|---|---|
| Hungry Horse | Flathead | 2,980,000 | 285,000 | Operating |
| Kerr | " | 1,217,000 | 168,000 | " |
| Thompson Falls | Clark Fork | – | 30,000 | " |
| Noxon Rapids | " | – | 336,000 | Under Construction |
| Cabinet Gorge | " | – | 200,000 | Operating |
| Albeni Falls | Pend Oreille | 1,153,000 | 42,600 | " |
| Box Canyon | " | – | 60,000 | " |
| Spokane River | Spokane | 105,000 | 146,350 | " |
| Grand Coulee | Columbia | 5,230,000 | 1,944,000 | " |
| Chief Joseph | " | – | 1,024,000 | " |
| Chelan | Chelan | 676,000 | 48,000 | " |
| Rocky Reach | Columbia | – | 711,550 | Under Construction |
| Rock Island | " | – | 212,100 | Operating |
| Wanapum | " | 330,000 | 600,000 | Licensed |
| Priest Rapids | " | 170,000 | 788,500 | Under Construction |
| McNary | " | – | 980,000 | Operating. |
| John Day | " | 500,000 | 1,200,000 | Under Construction |
| The Dalles | " | – | 1,119,000 | " " |
| Bonneville | " | – | 518,400 | Operating |
| Palisades (Incl. Jackson Lake) | Snake | 1,400,000 | 114,000 | " |
| Payette River Projects | Payette | 810,000 | 8,000 | " |
| Boise River Projects | Boise | 989,000 | 27,000 | " |
| Brownlee | Snake | 1,000,000 | 360,400 | Under Construction |
| Oxbow | " | – | 190,000 | " " |
| Hells Canyon | " | – | 341,000 | Licensed |
| Lower Granite | " | – | 300,000 | Authorized |
| Little Goose | " | – | 270,000 | " |
| Lower Monumental | " | – | 270,000 | " |
| Ice Harbor | " | – | 270,000 | Under Construction |
| Total | | 16,560,000 | 12,668,300 | |

*1/ Operating or to be installed as part of initial construction (nameplate rating)*

## PROPOSED PROJECTS

The projects selected for inclusion in the Major Water Plan are summarized in Table 48. A more complete summary of pertinent data for all projects studied is contained in Table 49 inserted at the end of this chapter. The Libby project, although authorized by Congress, is included in this listing rather than in the preceding table since action on the project by the International Joint Commission remains pending.

In addition to the dam and reservoir projects, an extension to the authorized navigation projects on Columbia River is proposed as an element of the Major Water Plan. Extension of barge navigation on Columbia River from the McNary pool approximately 110 miles upstream to the foot of Rock Island Dam can be obtained by channel excavation in the 57 mile reach to Priest Rapids Dam and construction of locks at Priest Rapids and Wanapum Dams.

The Asotin dam and reservoir project also will permit extension of navigation on Snake River some 30 miles above the present head of authorized navigation at Lewiston, Idaho.

TABLE 48

### PROPOSED PROJECTS SELECTED FOR INCLUSION IN THE MAJOR WATER PLAN

| Project | Stream | Total Avail. Storage (Acre-Feet) | Installed Capacity 1/ (kw) |
|---|---|---|---|
| Libby | Kootenai | 5,010,000 | 344,000 |
| Long Meadows | Yaak | 400,000 | 9,000 |
| Ninemile Prairie | Blackfoot | 885,000 | 60,000 |
| Flathead Lake | Flathead | 1,220,000 | 0 |
| Knowles | Flathead | 3,080,000 | 256,000 |
| Enaville | Coeur d'Alene | 700,000 | 30,000 |
| Garden Valley 2/ | Payette | 1,940,000 | 285,750 |
| High Mountain Sheep | Snake | 2,100,000 | 600,000 |
| Lower Canyon | Salmon | 2,500,000 | 640,000 |
| Wenaha | Grande Ronde | 900,000 | 134,000 |
| Asotin | Snake | pondage | 288,000 |
| Penny Cliffs | M.F. Clearwater | 2,300,000 | 292,000 |
| Bruces Eddy | N.F. Clearwater | 1,433,000 | 240,000 |
| Totals | | 22,468,00 | 3,178,750 |

*1/ Initial*

*2/ Garden Valley Division, including Scriver Creek Plants*



[fol. 16880]

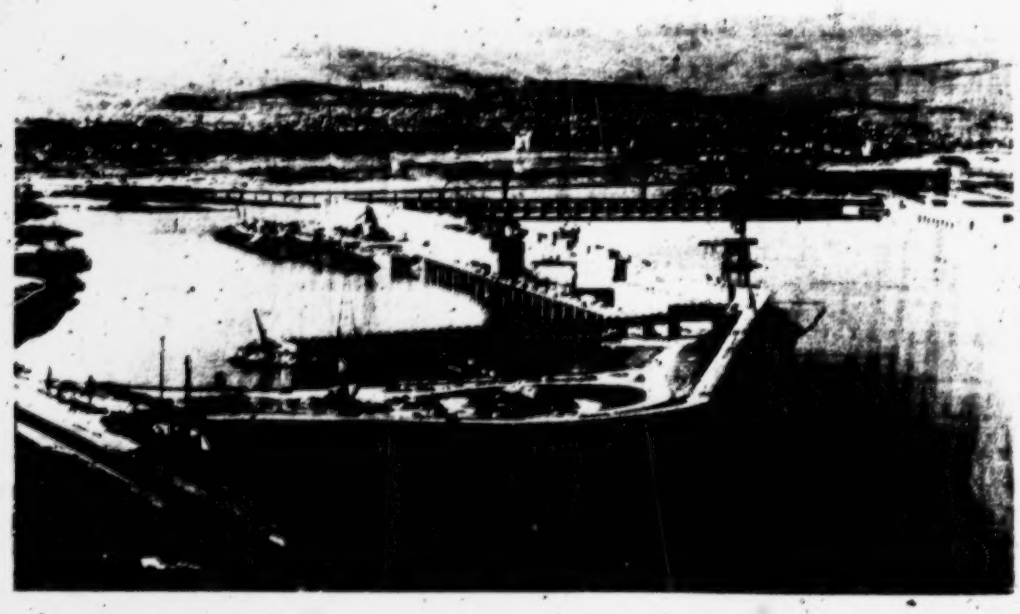
# Coordinated System Operation

Operation of the projects in the Major Water Plan will require close coordination among the numerous projects for the several uses if optimum system benefits are to be realized from the development of the water resource of the basin. The runoff characteristics of the Columbia River generally facilitate the establishment of workable and efficient plans for the operation of multiple-purpose developments. The drawdown of the several reservoirs during the fall and winter to augment the natural low flows of the river, mainly in the interest of power production, is consonant with the subsequent needs for flood control. This drawdown makes reservoir space available in the late spring to receive flood flows and reduce spills. This replenishment serves summer recreation and conservation needs and in the fall is available for repetition of the drawdown cycle for power. On the whole, the system can be operated in very good harmony for the several water uses.

Operation of the system for flood control is properly a Federal responsibility. It is a nonreimbursable benefit and therefore is without monetary incentive. Estimates of total spring and summer water yield and estimates of the probable maximum performance during flood season runoff are basic factors in formulating operating plans and require the assembly of much basic data and the application of practiced techniques in system regulation. Central control during the flood period in executing the operation of all flood storage projects is imperative. Not all flood regulation can be achieved without some encroachment on other uses. In all cases, thorough analysis must be applied to the requirements for flood control and other water uses. For any nonfederal projects, appropriate specific provisions for flood control where applicable must be stipulated in the terms of the Federal Power Commission license.

Operation for power generation requires coordination and cooperation among all operating entities to produce maximum over-all benefits for the region. This generally is being achieved by participation of all operating utilities in the Northwest Power Pool and is aided by the major transmission system of the Bonneville Power Administration. The Pool operates primarily on a credit and loan basis, surpluses from one area being used for assistance in meeting loads in another. The power benefits summarized in this report are based on integrated system operation wherein upriver plants have been regulated for maximum system power production. This is not always fully compatible with load requirements of the individual operating utilities. License provisions for nonfederal projects should reflect the results of thorough studies of all such situations and contain stipulations to assure the accomplishment of the maximum system benefit.

*General view of The Dalles Dam – the city of The Dalles and Mt. Hood in the background.*







[fol. 16881]

Operating conditions will change with the status and magnitude of system development. Flood control regulation will be greatly eased with more adequate storage. With the inadequate reservoir capacities currently available, the achievement of any specific intermediate goal of control is less than certain. Until full slack water navigation is accomplished, the regulation of river flows for the joint benefit of navigation and power generation will require close coordination between water movements and power peaking cycles to avoid disturbing conflicts. When large amounts of thermal power are introduced in the future, installations will be increased at nearly all hydro power projects and the more extreme variations in river discharges derived from high daily and hourly variations in power demand will require very close coordination between all river plants. Fluctuations must be avoided which are unduly harmful to other functions such as navigation, recreation and the many riparian water uses.

Recognition of such future operating conditions is important and appropriate flexibility in the provisions of the license to permit periodic reappraisal is essential.

## Possible Future Elements of Major Water Plan

The following projects are regarded as worthy of consideration for possible future construction. They have not been selected for specific inclusion in the Major Water Plan at this time for the varying reasons indicated. However, requirements and situations may change in the future and some of those projects may very well fit into an expanded resource development plan.

| Project | Stream | Remarks |
|---|---|---|
| Mica Creek | Columbia | Canadian project of indefinite status |
| Arrow Lakes | Columbia | do |
| Mile 204.9 | Kootenai | Run-of-river project for power only, suitable for later nonfederal development if Libby storage is provided. |
| Kootenai Falls | Kootenai | do |
| Katka | Kootenai | do |
| Upper Yaak Canyon | Yaak River | Run-of-river power potential of present marginal economics suitable for further consideration for nonfederal development. |
| Lower Yaak Canyon | Yaak River | do |
| Smoky Range | NF Flathead | Deferred because of infringement on boundary of Glacier National Park. |
| Spruce Park | NF Flathead | Requires further consideration of effect on primitive area resources. |
| Coram | Flathead | Run-of-river power potential of present marginal economics suitable for further consideration for nonfederal development. |
| Plateau | Clark Fork | do |
| Quarts Creek | Clark Fork | Run-of-river project suitable for nonfederal development. |
| Superior | Clark Fork | Run-of-river power potential of present marginal economics suitable for further consideration for nonfederal development. |
| Quinn Springs | Clark Fork | do |
| Boundary | Pend Oreille | Run-of-river project under study for nonfederal development. Alternative plans also under study by nonfederal interests. |
| Chiwawa | Chiwawa | Small project suited to nonfederal development. |
| Plain | Wenatchee | Large storage potential with major adverse effects on present recreation and fishery resources. |
| Crevice | Salmon | Deferred because of possible impact on fish runs and wilderness area. |
| Freedom | Salmon | Run-of-river project suitable for development after Crevice storage is available. |
| Six run-of-river plants | Clearwater | Small projects suited to nonfederal consideration following upriver reservoir construction. |
| Guffy | Snake | Under study by the Bureau of Reclamation. |
| Burns Creek | Snake | do |
| Other Snake River potentials | Snake | Upper Snake River projects under study by the Bureau of Reclamation and the Corps of Engineers which would have only minor effects on the balance of the Columbia Basin. |
| China Gardens | Snake | Run-of-river power project suitable for later development. |
| Ben Franklin | Columbia | Project of marginal feasibility. Also some adverse effects on Hanford Works of Atomic Energy Commission. |
| Wells | Columbia | Run-of-river project under study for nonfederal development. |
| Bonneville Lock | Columbia | Dependent upon traffic increases and further benefits. |



[fol. 16882]

# CHAPTER IX

# ACCOMPLISHMENTS OF THE MAJOR WATER PLAN

The preceding chapter has discussed the various proposed projects which will compose a practical and reasonably full development of the Columbia Basin water resources. The Major Water Plan includes not only the proposed projects but also all projects forming a part of the coordinated system for water resources development for flood control, power, navigation and other uses in the Columbia Basin that have been completed, are under construction, have been authorized or have been licensed for construction. It does not include projects in the Willamette River Basin or other basins entering the lower river which do not offer opportunity for coordinated streamflow operation. Elements of the Major Water Plan are listed in Tables 47 and 48 of Chapter VIII. Over-all accomplishments of the Plan are examined and discussed in this chapter.

## *FLOOD CONTROL*

Projects of the Major Water Plan would effect a very large reduction in the discharge and stage of major floods on the lower Columbia River and would protect many flood zones on the tributaries from further serious flood damage. Usable flood control storage of the Major Water Plan reservoirs totals 32,400,000 acre-feet, an amount that would reduce flows at The Dalles for three major floods of record, as follows:

| | Peak Discharge - cfs | | |
|---|---|---|---|
| Flood | Unregulated | Regulated by Present Storage | Regulated by the MWP |
| 1894 | 1,240,000 | 1,030,000 | 590,000 |
| 1948 | 1,010,000 | 860,000 | 500,000 |
| 1956 | 920,000 | 720,000 | 450,000 |

The corresponding reductions in stage at Vancouver may be approximated by reference to the table of flows and stage on page 23. These results show that construction of the Major Water Plan would accomplish flow reduction for the 1894 flood far beyond the minimum objective of 800,000 cfs at The Dalles. This minimum objective can be achieved by projects having total usable flood control storage of 18,030,000 acre-feet as demonstrated in Chapter II in the analysis of effectiveness of the Group I projects of the Major Water Plan.

The levees along the lower Columbia River which are now completed, together with the program of levee improvements and the few new levees which have been authorized, will afford flood protection having an annual value of $14,300,000. Reservoirs having sufficient capacity to meet the minimum goal of control, 800,000 cfs at The Dalles, would add protection having an annual value of $20,630,000. This value would increase to $22,022,000 with operation of the full Major Water Plan. In addition, projects of the full plan would produce estimated average annual benefits totaling $5,736,000 for local flood damage reduction on the tributaries. The total flood control benefits contributed by the new storage projects of the Major Water Plan would be $11,012,000, which is approximately 8 percent of the total annual benefits produced by these projects for all uses evaluated.

Flood control benefits for each project of the Major Water Plan have been calculated on two bases: (1) operating in a system which achieves the basic goal of 800,000 cfs control; and (2) operating with an added group to complete the Major Water Plan and control to 600,000 cfs. Table 50 is a summary of the usable storage and the benefits for all projects under these two conditions. Local benefits accruing to each project are included in the table. The usable storage for control to 600,000 cfs is larger than for control to 800,000 cfs, where ample storage space is available, because of the longer period of control for 600,000 cfs. The storages and benefits are not additive.

The selection of projects for the Major Water Plan has resulted in a distribution of storage on the principal flood producing tributaries which reasonably approximates the storage requirements by tributaries based on a rational distribution of storage patterned



[fol. 16883]

TABLE 50

## FLOOD CONTROL BENEFITS

| River | Project | Control to 800,000 cfs | | Control to 600,000 cfs | | Local Benefits $ |
|---|---|---|---|---|---|---|
| | | Usable Storage (In Acre-Feet) | Benefits $ | Usable Storage (In Acre-Feet) | Benefits 1/ $ | |
| Kootenai | Libby | 5,010,000 | 4,840,000 | 5,010,000 | 514,000 | 815,000 |
| | Long Meadows | 370,000 | 290,000 | 400,000 | 41,000 | 126,000 |
| Clark Fork | Hungry Horse | 1,830,000 | 1,760,000 | 2,200,000 | 2/ | 525,000 |
| Pend Oreille | Flathead Lake Outlet | 690,000 | 620,000 | 1,218,000 | 111,000 | 36,000 |
| | Knowles | 3,080,000 | 2,860,000 | 3,080,000 | 316,000 | 131,000 |
| | Ninemile Prairie | 610,000 | 570,000 | 798,000 | 82,000 | 78,000 |
| Spokane | Enaville | 600,000 | 600,000 | 684,000 | 71,000 | 34,000 |
| Payette | Cascade and Deadwood | 420,000 | 479,000 | 490,000 | 2/ | 102,000 |
| | Garden Valley | 380,000 | 431,000 | 440,000 | 40,000 | 103,000 |
| Snake River Above Salmon | Palisades | 1,150,000 | 1,380,000 | 1,400,000 | 2/ | 1,090,000 |
| | Boise River | 240,000 | 290,000 | 240,000 | 2/ | 1,650,000 |
| | Brownlee | 1,000,000 | 1,310,000 | 1,000,000 | 2/ | 0 |
| | High Mt. Sheep | 1,550,000 | 1,819,000 | 2,100,000 | 228,000 | 0 |
| Salmon | Lower Canyon | 2,500,000 | 3,450,000 | 2,500,000 | 285,000 | 0 |
| Grande Ronde | Wenaha | 900,000 | 1,180,000 | 900,000 | 103,000 | 0 |
| Clearwater | Bruces Eddy | 1,430,000 | 1,880,000 | 1,430,000 | 155,000 | 397,000 |
| | Penny Cliffs | 2,300,000 | 3,015,000 | 2,300,000 | 262,000 | 649,000 |
| Main Stem | Grand Coulee | 5,230,000 | 6,820,000 | 5,230,000 | 2/ | 0 |
| | Priest Rapids-Wanapum | 500,000 | 670,000 | 500,000 | 2/ | 0 |
| | John Day | 500,000 | 670,000 | 500,000 | 2/ | 0 |

*1/ Benefits if project is added after achievement of 800,000 c/s goal.*

*2/ Flood control benefits shown for control to 800,000 c/s would be applicable.*

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after the tributary's record for contributing to major floods. Table 51 below, gaged to a controlled flow of 600,000 cfs at The Dalles, compares these requirements with the amounts of usable flood control storage contained in the Major Water Plan. The table also includes a listing of the maximum usable flood control storage on the several tributaries.

Because the selection of projects and determination of their size and storage capacity is in many cases fixed by other uses, particularly power, the distribution of flood control storage in the Major Water Plan does not entirely conform with the rational distribution (column 2 of Table 51) which represents the ideal distribution of flood storage with respect to major flood contributions. In all cases, however, the amount of usable storage space proposed for each tributary (column 5) is within the limit of the maximum amount of flood storage that could be used (column 6), as determined by routings of the 1894 flood.

TABLE 51

**SUMMARY OF FLOOD CONTROL STORAGE DISTRIBUTION**

**Control of 1894 Flood to 600,000 cfs at The Dalles**

| Basin | Rational Distribution of Total Requirement (Acre-Feet) | Usable Storage of the Major Water Plan (Acre-Feet) Existing | Recommended | Total | Maximum Usable Flood Control Storage for Basins at or Above Locations Indicated (Acre-Feet) |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| Kootenai | 7,400,000 | 0 | 5,410,000 | 5,410,000 | 8,500,000 (Libby and Long Meadows |
| Clark Fork-Pend Oreille | 6,500,000 | 2,200,000 | 5,096,000 | 7,296,000 | 11,100,000 (Paradise) |
| Spokane | 1,500,000 | 0 | 684,000 | 684,000 | 740,000 1/(Enaville) |
| Wenatchee | 500,000 | 0 | 0 | 0 | 960,000 (Plain) |
| Payette | 400,000 | 490,000 | 440,000 | 930,000 | 1,270,000 (Garden Valley and Cascade) |
| Snake above Salmon (except Payette) | 2,400,000 | 2,640,000 | 2,100,000 | 4,740,000 | 4,800,000 2/(Mountain Sheep) |
| Salmon | 3,200,000 | 0 | 2,500,000 | 2,500,000 | 5,660,000 (Lower Canyon) |
| Grande Ronde | 700,000 | 0 | 900,000 | 900,000 | 1,360,000 (Wenaha) |
| Clearwater | 3,600,000 | 0 | 3,730,000 | 3,730,000 | 5,200,000 (Bruces Eddy and Penny Cliffs) |
| Main Stem | 6,230,000 | 6,230,000 3/ | 0 | 6,230,000 3/ | |
| Total | 32,430,000 | 11,560,000 3/ | 20,860,000 | 32,420,000 3/ | |

*1/ Usable amount less than rational distribution because of limited tributary area above Enaville.*

*2/ Maximum usable assuming existing and recommended upstream storage shown for Payette River is available.*

*3/ Includes storage at the existing Grand Coulee Dam, John Day and Priest Rapids Dams under construction and Wanapum Dam which is licensed.*

[fol. 16885]

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*The snowpack, accumlating during winter months in the mountains. Snowmelt is the major source of runoff in the Columbia Basin.*

Another essential objective of the Major Water Plan was to obtain additional storage of at least 4,000,000 acre-feet above Grand Coulee in order to increase the effectiveness of present available storage in Franklin D. Roosevelt Lake for flood control. The Libby, Long Meadows, Knowles, Ninemile Prairie and Enaville projects and the increased utility of storage in Flathead Lake, all located above Grand Coulee, contain 11,190,000 acre-feet of usable flood control storage. However, this larger amount does not eliminate the need for improving the 60 outlets in Coulee Dam for greater evacuation prior to the flood peak.

With continued coordinated multiple-purpose operation of the storage proposed for the Major Water Plan, it may be expected that the flood control effectiveness of the plan will remain substantially constant in future years because of the general compatibility of such use with operation for power and other uses. In a combined hydrothermal power system, reduction in the amount of water spilled during spring runoff will be a primary economic objective; one that is ideally compatible with achieving maximum flood control effectiveness. At a time when the Major Water Plan has been completed and installations at hydro-electric projects reach their ultimate capacities, less than 3½ percent of river flow will be spilled. Insofar as possible, flows will be regulated at that time to less than the hydraulic capacities of the power projects which will correspond generally to 300,000 cfs at The Dalles project.

Future enlargement of the Major Water Plan or other additions to the plan prior to its full construction might modify the relative utility of individual project storage for flood control, but over-all effectiveness of the plan for flood control would not change materially. The addition of a large amount of Canadian storage, for example, would permit Grand Coulee to operate with less average drawdown prior to spring runoff, thereby increasing the project's average energy output, but the same amount of flood runoff would be stored in the over-all plan.

***POWER***

Operating under load conditions forecast for 1985, projects contemplated for the region would have an installed capacity of nearly 25,000,000 kw and would be capable of generating about 14,400,000 kw of average continuous (prime) power. Total salable annual generation would be about 143 billion kwh. A summary of these characteristics for the new projects recommended for inclusion in the Major Water Plan is contained in Table 52.

Figure 20 of Chapter VIII shows the power resources of the present and future phases of the Major Water Plan, including the independent resources, and their relation to the forecasted regional load. The following tabulation summarizes this comparison, based on the maximum and minimum load forecasts for the Northwest Load Area for 1985:

Load-Resource Comparison (1000 kw), Average Critical Period Energy

| | Maximum Forecast | | | Minimum Forecast | | |
|---|---|---|---|---|---|---|
| | Hydro Resource | Load Forecast | Thermal Reqmt. | Hydro Resource | Load Forecast | Thermal Reqmt. |
| Existing & reasonably assured projects | 10,400 | 22,800 | 12,400 | 10,400 | 16,500 | 6,100 |
| Full Major Water Plan including proposed new projects | 14,400 | 22,800 | 8.400 | 14,400 | 16,500 | 2,100 |



[fol. 16886]

TABLE 52

## ADDITIONAL POWER, MAJOR WATER PLAN

| Project | Initial Installed Capacity (kw) | Prime Power Credit (kw) | Ave. Ann. Energy (mil. of kwh) At-Site | Ave. Ann. Energy (mil. of kwh) Downstream |
|---|---|---|---|---|
| Libby | 344,000 | 956,000 | 1,885 | 2,142 |
| Long Meadows | 9,000 | 54,500 | 46 | 140 |
| Ninemile Prairie | 60,000 | 130,000 | 167 | 298 |
| Knowles | 256,000 | 697,000 | 1,323 | 1,200 |
| Enaville | 30,000 | 143,000 | 175 | 298 |
| Garden Valley | 286,000 | (271,400) 1/ | 1,420 | 31 |
| High Mt. Sheep | 600,000 | 637,000 | 4,800 | 35 |
| Lower Canyon | 640,000 | 477,000 | 2,978 | 454 |
| Asotin | 288,000 | 168,000 | 1,708 | |
| Wenaha | 134,000 | 135,000 | 630 | 80 |
| Penny Cliffs | 292,000 | 342,000 | 1,708 | 412 |
| Bruces Eddy | 240,000 | 236,000 | 1,349 | 228 |
| Subtotal | | | 18,189 | 5,318 |
| Total | 3,179,000 | 3,975,500 2/ | 23,507 3/ | |

*1/ Benefits for Garden Valley development evaluated on the basis of dependable capacity.*

*2/ Not including Garden Valley. Total prime in excess of 4,100,000 kw during period Garden Valley storage operated for downstream power.*

*3/ Total incremental project additions. In Major Water Plan, they would collectively add a total of about 28,000 million kwh.*



[fol. 16887]

The net savings to the region resulting from these new projects, in lieu of alternative thermal generation, would be about $60 million annually.

Completion of the Major Water Plan would materially increase the uniformity of flow in the Columbia River and in the tributaries. This is illustrated in Table 53 which repeats the 1968 conditions shown on page 347, to permit comparison with the improved regulation conditions of 1985 and 2010, effected by operation of the full Major Water Plan. Data for 2010 load conditions reflect the lesser use of storage in a mature hydrothermal system, as discussed in Chapter III and illustrated in Figure 12.

Within practical limits of development, the potential power in the United States' portion of the Columbia River Basin, above and including Bonneville, is nearly 17,000,000 kw of average annual generation as shown in Table 42 of Chapter VIII. Of this total; nearly 10,000,000 kw would be developed with the projects completed, under construction, authorized and licensed. Completion of the Major Water Plan would increase the development to about 13,200,000 kw or 78 percent of the United States' potential. Other future projects discussed in this report would permit eventual development of better than 98 percent of this practical objective. A summary of this study by tributaries is shown in Table 54.

Operating under 1985 loads, storage projects of the Major Water Plan would derive about 59 percent of their benefits from generation at the project and at downstream plants on the tributaries and 41 percent from increased generation at main river plants. Under the ultimate conditions of development and operation of the hydro elements in a hydrothermal system, the division of benefits would approach 95 percent for at-site and tributary generation and 5 percent downriver.

If storage projects are introduced on the Columbia River in Canada prior to completion of the Major Water Plan, such storage would contribute to the regulatory objectives for flood control and downstream power generation. The theoretical system value of such storage would vary with system growth as explained in Chapter III for projects of the Major Water Plan. Evaluation of Canadian storage must weigh its contribution to the United States at all stages of system development. The evaluation, however, should not be allowed to preempt benefits creditable to remaining prospective Major Water Plan projects to the extent that such projects, which would be of lasting and widespread benefit to the economy of the United States, would become unattainable.

### *NAVIGATION*

The Major Water Plan provides for two extensions to the authorized improvements for navigation on the Columbia River: (1) extension of barge navigation on Columbia River above the McNary pool to the foot of Rock Island Dam by open-river improvement and installation of locks in the Priest Rapids and Wanapum Dams; and (2) extension of slack water barge navigation on Snake River above Lewiston by construction of the Asotin project in lieu of the previously proposed open-river improvement. The Columbia River extension would bring a larger additional tributary area into focus for potential utilization of the river for economical transportation of many of its products and requirements. On the Snake River the proposed modification in the navigation plan would provide slack water navigation access to the extensive limestone deposits above Lewiston and to a limited additional tributary area for more general commerce.

These improvements will result in an estimated average annual saving to the region in transportation costs of about $5,426,000 after a short period for development of commerce following completion of the entire navigation system. The extended navigation system undoubtedly would foster material expansion of industry in the inland area with resulting large indirect benefits. These are not included in the evaluated navigation savings.

### *RECREATION*

Full attention has been given to the recreational value of all proposed projects as appraised in the detailed reports of the National Park Service and the Forest Service. Adequate facilities will be provided in each case, either by the construction agency in collaboration with local governmental bodies, or by the Forest Service where the reservoirs are in national forest lands. The proposed reservoirs of the Major Water Plan will have 330 square miles of water area and will provide excellent and much needed opportunities for such activities as fishing, boating, swimming, picnicking, and camping. Summarizing estimates prepared by the National Park Ser-



[fol. 16888]

TABLE 53

## COMPARATIVE DEGREES OF STREAMFLOW REGULATION

### Percent of Average Annual Runoff for Power Study Period 1928-1948

| Basin | W/Projects Existing or Under Construction | | With Full Major Water Plan | | | |
|---|---|---|---|---|---|---|
| | 1968 Load Conditions | | 1985 Load Conditions | | 2010 Load Conditions | |
| | Sep-Mar (58% of Time) | Apr-Aug (42% of Time) | Sep-Mar (58% of Time) | Apr-Aug (42% of Time) | Sep-Mar (58% of Time) | Apr-Aug (42% of Time) |
| Kootenai | 24 | 76 | 60 | 40 | 53 | 47 |
| Clark Fork-Pend Oreille | 48 | 52 | 57 | 43 | 49 | 51 |
| Spokane | 40 | 60 | 56 | 44 | 55 | 45 |
| Wenatchee | 28 | 72 | 28 | 72 | 28 | 72 |
| Snake above Salmon | 61 | 39 | 68 | 32 | 1/ | 1/ |
| Payette | 26 | 74 | 1/ | 1/ | 1/ | 1/ |
| Salmon | 25 | 75 | 51 | 49 | 56 | 44 |
| Grande Ronde | 36 | 64 | 68 | 32 | 62 | 38 |
| Clearwater | 28 | 72 | 63 | 37 | 59 | 41 |
| Columbia in Canada | 27 | 73 | 27 | 73 | 27 | 73 |
| Columbia at Grand Coulee | 40 | 60 | 47 | 53 | 44 | 56 |
| Snake River | 41 | 59 | 62 | 39 | 60 | 40 |
| Columbia at The Dalles | 42 | 58 | 52 | 48 | 51 | 49 |

*1/ Data not available.*

[fol. 16889]

TABLE 54

## SUMMARY OF PRACTICAL LIMITS OF POWER DEVELOPMENT

| Basin | Average Annual Generation in 1000 kw | | | | | |
|---|---|---|---|---|---|---|
| | Total Potential | Exist, Under Const, Auth, or Licensed | Recommended Projects | | Other Potential Projects 2/ | Remaining Undeveloped |
| | | | At Site | Added at D/S Plants 1/ | | |
| Kootenai | 593 | 1 3/ | 222 | 0 | 340 | 30 |
| Clark Fork | 1,927 | 663 | 170 | 48 | 828 | 218 |
| Spokane | 279 | 116 | 27 | 64 | 72 | 0 |
| Wenatchee | 201 | 2 | 0 | 0 | 193 | 6 |
| Salmon | 896 | 0 | 340 | 0 | 496 | 60 |
| Grande Ronde | 133 | 0 | 72 | 0 | 61 | 0 |
| Clearwater | 695 | 9 | 348 | 0 | 281 | 57 |
| Middle & Lower Snake | 2,515 | 1,465 | 743 | 136 | 171 | 0 |
| Trib. Total | 7,239 | 2,256 | 1,922 | 248 | 2,442 | 371 |
| Columbia | 9,657 | 7,738 | 380 4/ | 474 | 1,065 | 0 |
| Basin Total | 16,896 | 9,994 | 2,302 5/ | 722 5/ | 3,507 | 371 |

*1/ Additional generation obtained at existing, etc. downstream plants on tributary or main stem as listed.*

*2/ Includes downstream generation.*

*3/ Not including Libby. (Libby included under recommended projects).*

*4/ Additional generation of existing projects due to increased installation.*

*5/ Summation of at-site and downstream power for recommended projects = 3,024 mw, not including Garden Valley. Including Garden Valley the total increase would be 3,194 mw average.*

[fol. 16890]

vice, the aggregate attendance for all new projects of the Major Water Plan totals 375,000 visitor-days annually, producing yearly recreational benefits of $600,000.

### FISH AND WILDLIFE

Analysis of projects for the Major Water Plan has been made with studied recognition of fish and wildlife values and problems. Relative evaluation among the tributaries of the present and future utility for fish and wildlife has been a constant and important consideration in weighing project selections..

Preliminary appraisal by the Fish and Wildlife Service of nearly all the projects studied in this report are contained in Appendix D and are summarized in the individual project descriptions of Chapter VII. In accordance with these studies, three of the Major Water Plan projects, Long Meadows, Ninemile Prairie, and Garden Valley would increase the value of the local fishery resource. The sum of the estimated annual benefits resulting from this improvement at Long Meadows and Ninemile Prairie is $535,000. The benefits at Garden Valley have not been evaluated. The cost estimates for all projects contain funds for detailed examination, planning and construction of facilities for maintaining, and wherever reasonably possible, improving the fish and wildlife resource. Total funds included for this purpose in cost estimates for new Major Water Plan projects are over $58,000,000. The extent of land to be acquired and facilities to be provided for fish and wildlife purposes in connection with projects proposed in this report have been established only in general terms. Such information has been included as a part of the project proposals for the information and approval of Congress. Before any of the land acquisition or work on facilities is accomplished, studies will be completed to assure that such expenditures are justified as contemplated by the Fish and Wildlife Coordination Act.

### OTHER ACCOMPLISHMENTS

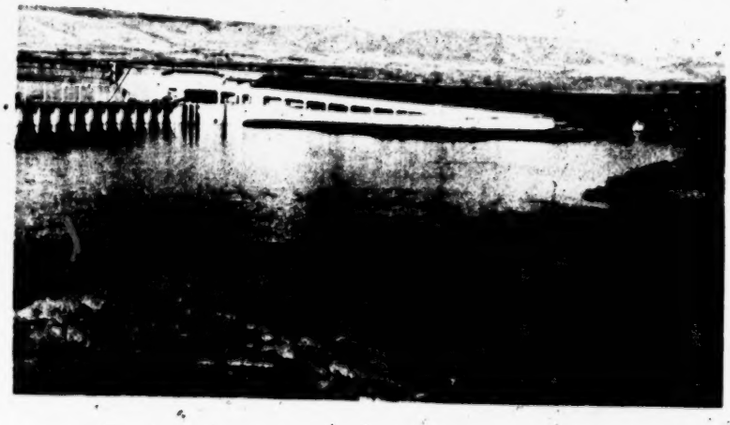
Although not subject to evaluation at this time, substantial benefits will accrue to the region by virtue of the increased low water flows which will be maintained with the storage provided by the Major Water Plan. Although a minimum discharge of 35,000 cfs was recorded at The Dalles during the winter freeze-up period of January 1937, the average flow during the months of September through March, 1929 through 1947, was in the magnitude of 91,000 cfs before storage regulation. At the present time, this low water flow has been increased to average flows of about 112,000 cfs. With completion of the Major Water Plan, the average low water flows will be approximately 138,000 cfs or a 52 percent increase over natural conditions.

Such regulation, storing the surplus flows and releasing this water to maintain higher low water discharge, will provide many benefits which will increase with the passage of time. Most important among these are domestic water supply uses, benefits from pollution abatement, and benefits to the fish and wildlife resource.

The Garden Valley project as proposed by the Bureau of Reclamation will eventually provide material direct irrigation benefits to the Payette Basin. Other storages also will be beneficial to future irrigation in providing direct water service in the area and in augmenting water supplies to downstream areas for diversion or direct pumping from the river channels. No attempt has been made to evaluate these irrigation benefits except in the case of Garden Valley.

### ACCOMPLISHMENTS OF FUTURE ELEMENTS OF THE MAJOR WATER PLAN

Other projects as outlined in Chapters VII and VIII remain for possible future development. The smaller run-of-river power projects are of lesser regional importance and are best suited for nonfederal development for single purpose of local use benefits. Certain projects in the Canadian portion of the basin, such as Mica and Arrow Lakes storages, could be of material benefit to the United States if developed in the reasonably near future.



*One of the fish ladders at The Dalles Dam.*

# CONCLUSIONS

The Major Water Plan as summarized in Tables 47 and 48 of Chapter VIII, supplemented by economical head plants on the tributaries, would encompass most of the economic and practicable project opportunities currently foreseeable. Twelve new multiple-purpose projects, and the authorized Libby project are included in the plan. The estimated construction cost of these projects, based on initial power development is $1,832,170,000. Additional annual benefits total $150,831,400 and the over-all benefit-cost ratio of these projects considered as a group is 1.66. Extension of barge navigation on the Columbia River from the head of McNary pool to the foot of Rock Island Dam, at an estimated cost of $64,973,000, also is included in the Major Water Plan. Accomplishment of this program in a 15-year period from 1960 to 1975 and including completion of John Day and the four lower Snake River projects, which would be compatible with the "average" prediction of regional power load growth, would require an average annual expenditure of about $184 million.

It is evident from the magnitude of the water resource needs discussed herein that the combined efforts and funds of Federal, State, local and private organizations very likely will be called upon to meet the requirements of the region and to assure its economic growth. Many elements are suitable for non-federal development. However, the integrity of the over-all program must be preserved by inclusion of appropriate provisions in those projects which may be licensed to insure fully coordinated system operation for optimum resource utilization.

Cost and benefit data for new elements of the Major Water Plan are shown in the tabulation below.

**COST AND BENEFIT DATA, NEW MAJOR WATER PLAN PROJECTS**

| Project | Stream | Construction Cost 1/ | Annual Costs | Annual Benefits | Benefit-Cost Ratio 7/ |
|---|---|---|---|---|---|
| Libby (authorized project) | Kootenai R. | $ 307,900,000 | $14,732,000 | $ 29,428,000 | 2.00 |
| Long Meadows | Yaak River | 25,709,000 | 1,218,400 | 2,009,000 | 1.65 |
| Ninemile Prairie 2/ | Blackfoot R. | 54,893,000 | 2,703,900 | 4,546,000 | 1.68 |
| Flathead Lake Outlet Improvement | Flathead R. | 6,142,000 | 236,000 | 656,000 | 2.78 |
| Knowles | " | 234,910,000 | 11,213,000 | 18,738,000 | 1.67 |
| Enaville | Coeur d'Alene | 78,036,000 | 3,562,200 | 4,448,000 | 1.25 |
| Garden Valley Division 2/ | Payette R. | 146,100,000 | 6,559,000 3/ | 9,906,000 3/ | 1.51 |
| High Mountain Sheep | Snake R. | 226,333,000 | 12,902,400 | 28,373,000 | 2.20 |
| Lower Canyon | Salmon R. | 194,520,000 | 10,993,200 | 22,155,000 | 2.02 |
| Wenaha | Grande Ronde | 94,574,000 | 4,411,000 | 5,931,000 | 1.34 |
| Asotin | Snake R. | 125,851,000 4/ | 6,444,000 | 10,748,000 | 1.67 |
| Penny Cliffs | MF Clearwater | 210,036,000 | 9,635,000 | 15,442,000 | 1.60 |
| Bruces Eddy | NF Clearwater | 127,166,000 | 6,165,000 | 11,363,000 | 1.84 |
| Subtotal | | $1,832,170,000 | $90,775,100 | $150,831,400 5/ | 1.66 |
| Navigation extension to Rock Island | Columbia R. | 64,973,000 6/ | 2,951,000 | 3,271,000 | 1.11 |
| Total | | $1,897,143,000 | $93,726,100 | $154,102,400 5/ | 1.64 |

*1/ Excludes preauthorization study costs.*

*2/ As planned and proposed by U. S. Bureau of Reclamation.*

*3/ Not including taxes.*

*4/ Includes $171,000 for navigation aids.*

*5/ This total, which reflects the total system flood control benefits for control to 600,000 c/s at The Dalles, is $12,912,000 less than the sum of the individual project benefits tabulated above which assume each project participating in the base system for control to 800,000 c/s at The Dalles. (See pp. 34 and 35.)*

*6/ Includes $105,000 for navigation aids. Excludes $225,000 for initial provisions by nonfederal interests for future navigation lock at Priest Rapids.*

*7/ With early flood control benefits.*



[fol. 16892]

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Storage capacities in the Major Water Plan have been distributed among the tributaries in the United States in reasonable conformity with the flood producing characteristics and power regulatory requirements of the subbasins. The plan has 37 million acre-feet of usable storage and would reduce the maximum flood to 590,000 cfs at The Dalles, well below the minimum goal of 800,000 cfs. This further objective would be achieved without special cost because of the compatibility of storage use for flood control and power regulation. A combination of levees and regulation by storage is the most practicable means of providing adequate protection against severe floods in the extensive low valley areas along the lower Columbia River. Modification of the outlets in Grand Coulee Dam should be prosecuted diligently to permit early increased utilization of available storage at this project for flood control.

The proposed plan for the Clark Fork Basin includes the Knowles project and has been selected in lieu of a plan including the larger Paradise project. The accomplishments of the selected plan would be 95 percent of those of the larger plan and are obtainable at 65 percent of the cost and with much less disruption to developments in the area.

In the Middle Snake River area, the proposed plan includes the High Mountain Sheep and the Lower Canyon projects which, in effect approximates a two-stage development of the alternative, economically attractive, Nez Perce project. Allowing for a probable 12-year minimum delay before clearance could be obtained to initiate action for high dam construction on or below the Salmon River, the selected plan would have a benefit-cost ratio equal to the plan with Nez Perce. However, it is proposed to delay recommendation for authorization and construction of Lower Canyon pending development of adequate fish passage facilities. Such action is considered warranted in the interest of protecting the valuable fisheries resource of the Salmon River. Partial diversion of the Salmon River by tunnel to the High Mountain Sheep project, which would produce nearly 40 percent of the benefits of the Lower Canyon project, is an alternative possibility to Lower Canyon in the event of indefinite delay in large project construction on the Salmon River. Tested development of practicable and efficient means of collecting and passing downstream migrants over high dams in about 10 to 12 years is considered likely, but early acceptance of such results by conservation groups for application to the Salmon River is doubtful.

Although the proposed Wenaha project on the Grande Ronde River would intercept only 7 percent of the migratory fish runs above McNary Dam, this project is less economically attractive than others and a delay of 5 to 7 years in beginning construction is considered advisable in the general interest of the fishery resource.

The Libby project which was authorized in the Flood Control Act of 1950 has been retained as an element of the Major Water Plan. It would produce large benefits locally and downstream. Its construction, however, must await satisfactory agreement with Canada.

The National Park Service and the Forest Service have evaluated the recreational use of the projects and the cost estimates contain allowances for adequate access and facilities. The Fish and Wildlife Service has proposed measures which would increase the natural fishery resource at three of the projects and has proposed a program of measures and facilities for maintenance of the resource or mitigation of losses at others. These proposals, with a few exceptions as noted in Chapter VII, have been included in the project estimates. Fish and wildlife is recognized as one of the project purposes where benefits for this use have been evaluated.

The regional power load probably will expand beyond the hydro-electric capability of the Major Water Plan before 1975. While a few of the potential future projects listed on page 380 may be selected for later development, a very large part of the additional energy needed beyond 1975 must come from thermal sources. The storage of the Major Water Plan, as analyzed for 1985 loads, would be effectively utilized to maintain a high level of average continuous (prime) power. Later in the 50-year economic life of new projects, with a preponderance of thermal power in the system, storage utilization would change. Reservoirs would be rapidly drafted in late winter and early spring at rates usable by enlarged downstream power installations, then would be refilled from flood runoff in excess of downstream usable flow. Reservoirs would be evacuated only to levels necessary to prevent later spill and thus would automatically provide maximum flood reduction. Diminishing prime power values would be offset by system benefits from reduced



[fol. 16893]

spill and increased peaking capability at the storage project powerplant.

Storage projects on the Columbia River in Canada would be of material benefit for some time to projects in the United States. When Canada will be in a position to utilize its large potential on the Columbia River is uncertain. Whether Canadian storage is installed or not, completion of the Major Water Plan would be essential for utilization of the generous resources available on tributaries in the United States. These developments would have lasting value, even in a large thermal-based system.

Barge line operators are beginning to employ equipment which can be loaded to drafts of about 12 feet, and upon completion of the slack water navigation system, can be expected to load to this depth consistently. Improvement of slack water channels to a width of 250 feet and a depth of 14 feet is desirable. Required improvement is limited largely to downstream lock approach channels, and cost estimates of the individual projects are adequate for this work.

Large future depletions for new irrigation have been recognized in evaluating the hydroelectric power production of the Major Water Plan. Except for the Upper Snake River Basin and for some areas in the headwaters of various streams, adequate supplies for expanded acreages will be available from flows regulated by the Major Water Plan. Water needs for domestic and industrial uses are difficult to predict, but would be very small compared to irrigation demands.

Three new projects in the Willamette River Basin and one project modification are proposed as economically justified additions to the authorized comprehensive plan. These additions include Gate Creek and Strube Reservoirs in the McKenzie River Basin, the latter for reregulation below the Cougar project; the Cascadia Reservoir on the South Santiam River; and modification to the existing Fern Ridge project near Eugene to permit an increase in flood storage capacity. Cost and benefit data for these projects are contained in the following tabulation:

**COST AND BENEFIT DATA, NEW WILLAMETTE BASIN PROJECTS**

| Project | Stream | Construction Cost 1/ | Annual Costs | Annual Benefits | Benefit-Cost Ratio |
|---|---|---|---|---|---|
| Strube | S F. McKenzie River | $ 6,685,000 | $ 582,700 2/ | $ 647,000 2/ | 1 11 |
| Gate Creek | Gate Creek | 15,920,000 | 677,500 | 887,400 | 1.31 |
| Fern Ridge (modification) | Long Tom River | 140,000 | 5,000 | 13,800 | 2.76 |
| Cascadia | South Santiam | 28,270,000 | 1,171,700 | 1,532,800 | 1.31 |
| | | $51,015,000 | $2,436,900 | $3,081,000 | |

*1/ Excludes preauthorization study costs.*

*2/ Annual costs and benefits are total incremental amounts associated with Strube and peaking installation at Cougar compared to initial high load factor installation at Cougar.*



[fol. 16894]

# Recommendations

The Division Engineer recommends that the following projects of the Major Water Plan for development of the water resource of the Columbia River Basin be authorized for construction:

Long Meadows project, Yaak River, Montana, at an estimated construction cost of $25,709,000.

Ninemile Prairie project, Blackfoot River, Montana, at an estimated construction cost of $54,893,000 as planned and proposed by the Bureau of Reclamation.

Flathead Lake Outlet Improvement, Flathead River Montana, at an estimated construction cost of $6,142,000.

Knowles project, Flathead River, Montana, at an estimated construction cost of $234,910,000.

Enaville project, Coeur d'Alene River, Idaho, at an estimated construction cost of $78,036,000.

Garden Valley Division, Payette River, Idaho, at an estimated construction cost of $146,100,000 as planned and proposed by the Bureau of Reclamation.

High Mountain Sheep project, Snake River, Idaho and Oregon, at an estimated construction cost of $226,333,000.

Wenaha project, Grande Ronde River, Washington and Oregon, at an estimated construction cost of $94,574,000.

Asotin project, Snake River, Idaho and Washington, at an estimated construction cost of $125,680,000 not including the cost of navigation aids.

Penny Cliffs project, Middle Fork Clearwater River, Idaho, at an estimated construction cost of $210,036,000.

Bruces Eddy project, North Fork Clearwater River, Idaho, at an estimated construction cost of $127,166,000.

Navigation Extension to Rock Island Dam, Columbia River, Washington, at an estimated construction cost of $64,868,000, not including the cost of navigation aids.

It is further recommended that the channel of the authorized Columbia-Snake barge navigation project be designated as 14 ft. by 250 ft. at minimum regulated flow.

The Division Engineer also recommends that the following projects be authorized as additions to the Willamette Basin plan:

Strube Reregulating Reservoir project, South Fork McKenzie River, Oregon, at an estimated construction cost of $6,685,000.

Gate Creek project, Gate Creek, Oregon, at an estimated construction cost of $15,920,000.

Modification of Fern Ridge project, Long Tom River, Oregon, at an estimated construction cost of $140,000.

Cascadia project, South Santiam River, Oregon, at an estimated construction cost of $28,270,000.

Allen F. Clark Jr.

ALLEN F. CLARK, JR.
Colonel, Corps of Engineers
Division Engineer

[fol. 16895]

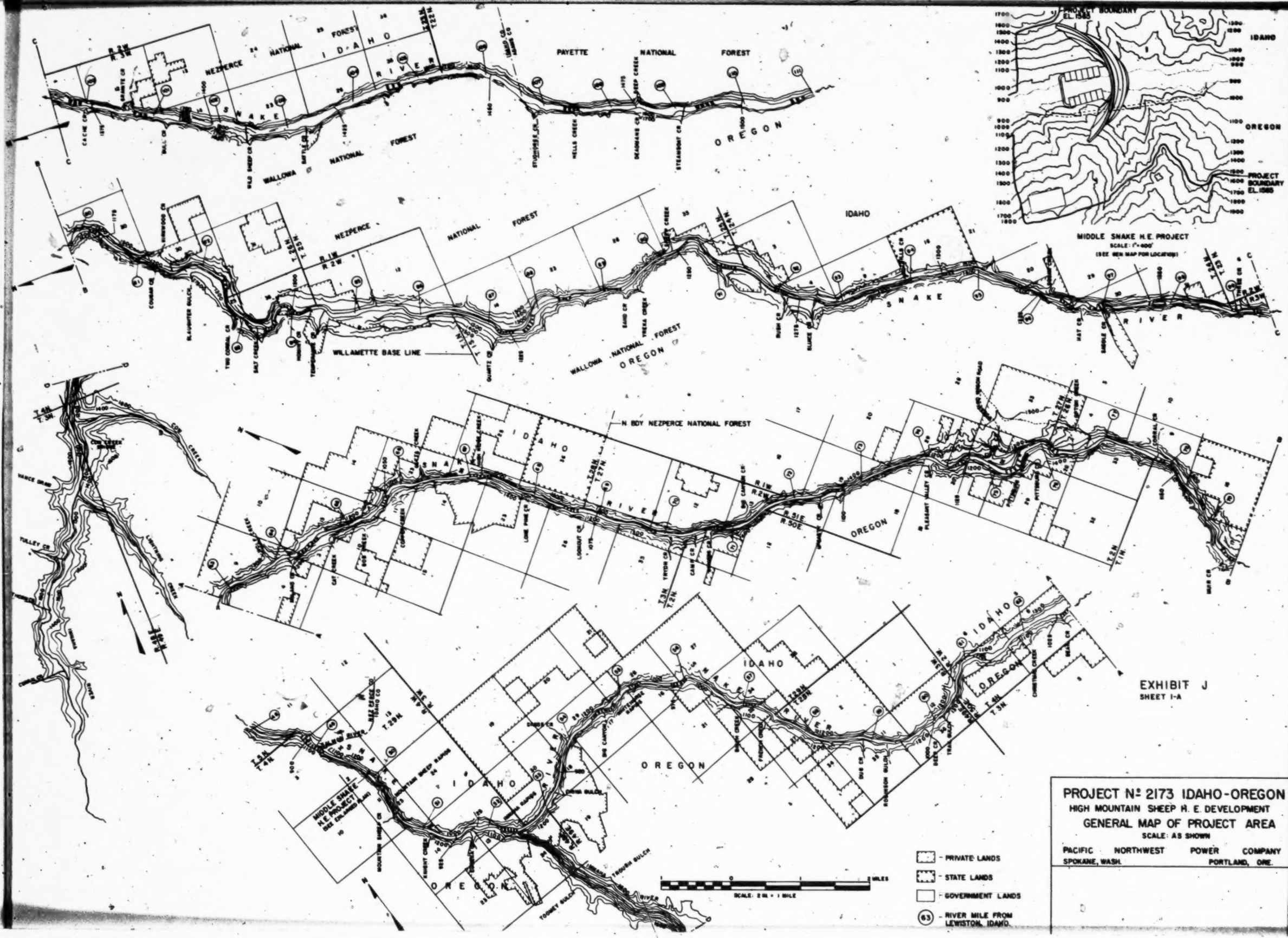


EXHIBIT J
SHEET I-A

PROJECT Nº 2173 IDAHO-OREGON
HIGH MOUNTAIN SHEEP H. E. DEVELOPMENT
GENERAL MAP OF PROJECT AREA
SCALE: AS SHOWN

PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

[fol. 25284]

BEFORE THE
FEDERAL POWER COMMISSION

Project No. 2243

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In the Matter of

PACIFIC NORTHWEST POWER COMPANY.

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PETITION FOR LEAVE TO INTERVENE—Filed April 18, 1958

Comes now National Hells Canyon Association, Inc., and Northwest Public Power Association, Interveners in Project No. 2173, and respectfully petition the Federal Power Commission for leave to intervene in the captioned matter pursuant to §308(a) of the Federal Power Act and §1.8 of the Commission's Rules and Regulations for the purpose of filing the accompanying Motion To Dismiss Application.

The filing of this petition has been duly authorized by your petitioners.

Statements descriptive of your petitioners are contained in the second paragraph of their petitions for leave to intervene in Project No. 2173, dated respectively October 27, 1955 and May 29, 1956 and are incorporated herein by reference.

As grounds for intervention, numbered paragraphs 1, 2, 8 and 9 of the Petition For Leave To Intervene filed in Project No. 2173 by National Hells Canyon Association, Inc., and numbered paragraphs 2, 8 and 9 of the Petition For Leave To Intervene filed in Project No. 2173 by Northwest Public Power Association are incorporated herein by reference. As additional ground for intervention, your pe-

[File endorsement omitted]

titioners allege that the pending application flies in the face of the Commission's decision in Project No. 2173, reaffirmed by the opinion and order on rehearing, issued April 11, 1958, and is therefore incompatible with the public interest in comprehensive development and utilization of the water resources involved, especially the development of storage for flood control, power production and other purposes.

Your petitioners therefore request the right to intervene for the purpose specified above and to seek from the Commission such order or other relief as may be appropriate [fol. 25285] pursuant to law or discretion vested in the Commission.

National Hells Canyon Association, Inc., Northwest Public Power Association, Hilmer & Cooper, Attorneys for Petitioners, 1025 Conn. Avenue, N.W., Washington 6, D.C., By: Evelyn N. Cooper.

April 18, 1958.

Subscribed and sworn to before me this 18th day of April, 1958.

Mary J. Brumley, Notary Public, D. C., My Commission Expires September 14, 1962.

[fol. 25286]

BEFORE THE
FEDERAL POWER COMMISSION

Project No. 2243

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In the Matter of

PACIFIC NORTHWEST POWER COMPANY

---

MOTION TO DISMISS APPLICATION—Filed April 18, 1958

National Hells Canyon Association, Inc., and Northwest Public Power Association, Petitioners for Intervention herein, move that the application in this proceeding be dismissed forthwith, for the following reasons:

1. Said application is so vague and indefinite as to contravene the Federal Power Act and the Rules and Regulations of the Commission which contemplate license applications only for specific, clearly defined projects; moreover, it seeks improperly to embrace multiple alternative—albeit unidentified—projects;

2. Whether the application be deemed a license application for a high Mountain Sheep project or for conflicting projects, it merely raises for readjudication the issue already adjudicated in Project No. 2173;

3. And, if the application be deemed a licensed application solely for a high Mountain Sheep dam, it is grossly incomplete and far short therefore of satisfying the Com-

[File endorsement omitted]

mission's Rules and Regulations, especially §§4.40, 4.41 and 4.42 thereof.

A memorandum in support of this motion is attached.

Respectfully submitted,

Hilmer & Cooper, Attorneys for Petitioners, 1025 Conn. Avenue, N.W., Washington 6, D.C., By Evelyn N. Cooper.

April 18, 1958.

Subscribed and sworn to before me this 18th day of April, 1958.

Mary J. Brumley, Notary Public, D. C., My Commission Expires September 14, 1962.

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[fol. 25287]

MEMORANDUM IN SUPPORT OF MOTION TO DISMISS APPLICATION

The application's fatal deficiencies stem from the preemptive strategy which underlies it; in effect, the applicant is seeking to achieve the alternative relief sought in its petition for rehearing in Project No. 2173, which the Commission has denied.

The application was filed in alleged pursuance of the original Mountain Sheep-Pleasant Valley preliminary permit, on March 31, 1958, the last day of the 3-year maximum effective period of said permit. Applicant erroneously assumes that said permit survived the filing of the application for a license for the Mountain Sheep-Pleasant Valley project and the Commission's denial thereof, and, moreover, that the permit can be construed as covering the whole of the Nez Perce reach notwithstanding that it was limited to two specific sites the development of which would involve a lesser reach. By this means and on these assumptions, applicant abortively attempts to freeze out any filing for a preliminary permit for the Nez Perce project by public bodies entitled to preference under §7(a) of the Act. And,

as if to make doubly sure of the accomplishment of that purpose, the application is so contrived as to leave room for the contention—however flimsy—that this is in fact an application for a license for the Nez Perce project and, as such, is entitled to priority consideration over an application for a preliminary permit for Nez Perce, even if filed by a preference body.

Applicant's preemptive strategy accounts not only for the vagueness and indefiniteness of the application but also for its incompleteness. By letter dated March 11, 1958, about 3 weeks before this filing, applicant advised the Commission that it would need about 10 more months in which to complete its study of a high Mountain Sheep project. The incompleteness of the application—if indeed it be an application for a high Mountain Sheep project—confirms the admitted need.

[fol. 25288] I

Section 9(a) of the Act requires that an applicant for a license shall furnish such data "as may be required for a full understanding of the proposed project." Similarly, §§4.40, 4.41 and 4.42 of the Commission's Rules and Regulations governing the contents of license applications speak of "the project."

Here, however, the application asks authorization for the "construction, operation and maintenance of the Middle Snake River Project, comprising such project works as shall be, in the judgment of the Commission, best adapted to a comprehensive development of that portion of the Columbia River System beginning at a point approximately at the confluence of the Salmon and Snake Rivers in the States of Oregon and Idaho and extending upstream thereof . . . " (p. 1). One would assume this to mean the Nez Perce project, since the Commission has found that to be the project for this river reach which is "best adapted to a comprehensive plan . . . " (Opinion No. 307). The only specific project data contained in the application suggests, however, that this is a license application for a high Mountain Sheep project. Doubt about what project is being proposed is

still further compounded by the statement in the application that "Applicant proposes to prepare and present to the Commission appropriate information on alternative developments of the same resources involved herein . . . " (p. 4). These "alternative developments" are unidentified.

An application so vague and indefinite does not satisfy the most elementary statutory requirement, calling for sufficient data "for a full understanding of the proposed project."

Moreover, this deficiency is aggravated by applicant's reference to "alternative developments" that would presumably be mutually exclusive. As noted above, the Act and the Commission's Rules and Regulations contemplate applications for single projects. While it is recognized that [fol. 25289] a single project can properly include multiple mutually consistent dams, it is submitted that it cannot properly include multiple mutually inconsistent dams.

II

Whether the application be deemed an application for a high Mountain Sheep dam or for conflicting dams, it raises again the basic issue that was adjudicated in Project No. 2173. The stated purpose of the application is to enable the Commission to "determine what project or combination of projects is . . . best adapted to a comprehensive development of the resources involved." The Commission has already determined and reaffirmed that for the area involved only the Nez Perce project could satisfy the statutory licensing standard. Nothing new has been disclosed to justify readjudication of that issue.

III

Also, if the application be deemed an application for a license for a high Mountain Sheep dam, it fails to meet the very precise requirements of §§4.40, 4.41 and 4.42 of the Commission's Rules and Regulations pertaining to the contents of applications. Contrary to these requirements, it

does not contain an estimate of cost—an omission which reflects meagre and incomplete design drawings (in fact, and perhaps as filler, the application includes design drawings for the rejected Mountain Sheep-Pleasant Valley project). Nor does the application contain information as to loads and resources and related operational characteristics, stream utilization, and compliance with State laws. In addition, the financial statement submitted is out-of-date, as is the statement pertaining to project lands and the information as to water rights.

In other words, even as an application for a single identified project, it is deficient in all major respects. [fol. 25290] And the nature and scope of the deficiencies are such that they cannot be cured by amendment in any reasonable period of time.

For any one and all of the foregoing reasons, the application should be dismissed.

Certificate of Service

I hereby certify that I have this 18th day of April 1958, mailed copies of the foregoing Petition For Leave To Intervene and the accompanying Motion To Dismiss Application, by first class mail, postage prepaid, to:

Allan A. Smith, Esq., Smith, Gray, Hill & Rodgers, Public Service Building, Portland, Oregon;

Norman A. Stoll, Esq., Special Asst. Attorney General, State Capitol, Salem, Oregon;

John C. Mason, Esq., Deputy General Counsel, Federal Power Commission, Washington 25, D. C.

Evelyn N. Cooper

[fol. 25335]

PACIFIC NORTHWEST POWER COMPANY

P. O. Drawer 1445

SPOKANE 10, WASHINGTON

September 23, 1959

Federal Power Commission
Washington 25, D. C.

Gentlemen:

There is enclosed herewith Amendment to our Application for License in the Middle Snake River Project No. 2173/2243.

Since the Pacific Northwest Power Company filed its application for license, the Board of Engineers for Rivers and Harbors of the United States Corps of Engineers has recommended that the normal pool elevation of the High Mountain Sheep Project be established at elevation 1510. Pacific Northwest Power Company has examined the proposed elevation and has concluded that the greater operational flexibility offered will justify the increased cost, and, accordingly, the Company is now altering the project plans. Furthermore, the project plans have been altered to provide for both an initial and ultimate capability consonant with the recommendations of the Corps of Engineers. The result of these alterations will be to provide potentially usable storage capacity at High Mountain Sheep in excess of 3,000,000 acre feet, together with an ultimate installed capability of 2,000,000 kilowatts.

As stated in paragraph 6 of the amended application, the applicant will install such fish facilities as shall be required for the conservation of the resident and migratory fish resources. The applicant has developed certain

plans for the management of the fishery resource of the Imnaha River, which will, with regard to that resource, avoid dependence upon experimental forebay fish trapping devices. For the information of the Commission and other interested parties, a brief outline of these facilities follows in this letter, together with a description of the facilities envisioned for handling main Snake River migratory fish. These proposed facilities are not included at this time in the application for license because the facilities that will actually become part of the licensed project will be such facilities as are finally recommended by the responsible conservation agencies.

## Fisheries Facilities for the High Mountain Sheep Project

Fishery facilities to be provided at the High Mountain Sheep project will be constructed to permit separate passage for the salmon and steelhead runs which enter the Imnaha River and the salmon and steelhead runs of the Snake River.

[fol. 25336] Entrances will be provided upstream from the powerhouses to allow for the entrance of anadromous fish into a common transportation channel which will connect with the separate passageway facilities to be provided for the Imnaha and Snake River fish. The attraction water to the entrance will be provided through diffusion chambers and from the outflow from the transportation facilities as a mixed flow of Snake and Imnaha River water.

The Imnaha River fish passage facility will be supplied by Imnaha River water provided by the Imnaha canal to be constructed, above the maximum pool level, from the regulating dam on the Imnaha River (described below) to the damsite. The Snake River fish will be attracted into their handling system by an attraction flow and released upstream from the dam. The Imnaha fish will enter the Imnaha canal for nor-

mal swimming passage through the canal to the channel of the Imnaha River.

Passage for the downstream migrants at this project will be provided to permit the Imnaha migrants to descend into the Snake River below the dam through the Imnaha canal. The passage for the Snake River downstream migrants will be provided by facilities equal to that by which the migrants are delivered to the project from the existing facilities at the next upstream dam. If downstream migrants are to be trapped and hauled, roads will be provided for the hauling and the migrants will be discharged below the dam. If the migrants are, however, discharged into the headwaters of the High Mountain Sheep reservoir, then appropriate trapping devices will be installed in the forebay.

Facilities are to be provided in the Imnaha River upstream of the normal pool level to divert 100 second feet of flow into the Imnaha canal, or the river discharge if less than 100 second feet, and the discharge of all flows above 100 second feet into the High Mountain Sheep pool. Mechanical screens will be provided to prevent the passage of fish into the High Mountain Sheep pool and to guide them into the Imnaha canal. A regulating dam will be constructed in the Imnaha channel to provide depth for such screening and to regulate the flow into the Imnaha Canal. The dam will be provided with a fishway to allow for the passage of fish which may enter the Imnaha River from the High Mountain Sheep pool. The Imnaha canal leading from this headworks to the main damsite will provide a low velocity to permit the upstream passage of adults by normal swimming and the descent of downstream migrants.

It should be made clear that applicant also proposes to provide such appropriate means of maintaining resident fish resources, and to take such measures as may be in-

dicated with regard to waterfowl and game in the area as may be reasonably requested by the responsible agencies. [fol. 25337] Applicant also expects to defray such portion of the annual cost of the operation and maintenance of fishery and wildlife facilities provided under the license as it should reasonably do pursuant to agreement with the conservation agencies of the States of Oregon and Idaho. The applicant will of course provide necessary engineering services for the design of all such facilities, and proposes to advance the costs of such other studies and investigations as may be required by the conservation agencies in connection with the design and approval of such facilities.

Applicant will advance a reasonable sum towards financing the cost of a master recreation plan for the development and use of the recreational opportunities afforded by the 58-mile-long reservoir created by the High Mountain Sheep Dam.

Applicant will arrange for the further examination of archeological matters of interest in that portion of the reservoir not already examined in the course of the former proceeding in this matter.

We request the Commission to forward copies of this letter, together with the application for license as amended, so that all interested parties may be informed of applicant's intentions in the premises.

Yours very truly,

John J. Burke, President.

JJB.1

[fol. 25372]

PACIFIC NORTHWEST POWER COMPANY

AMENDMENT OF APPLICATION FOR LICENSE

PROJECT NO. 2173/2243, HIGH MOUNTAIN SHEEP HYDROELECTRIC DEVELOPMENT

## EXHIBIT K

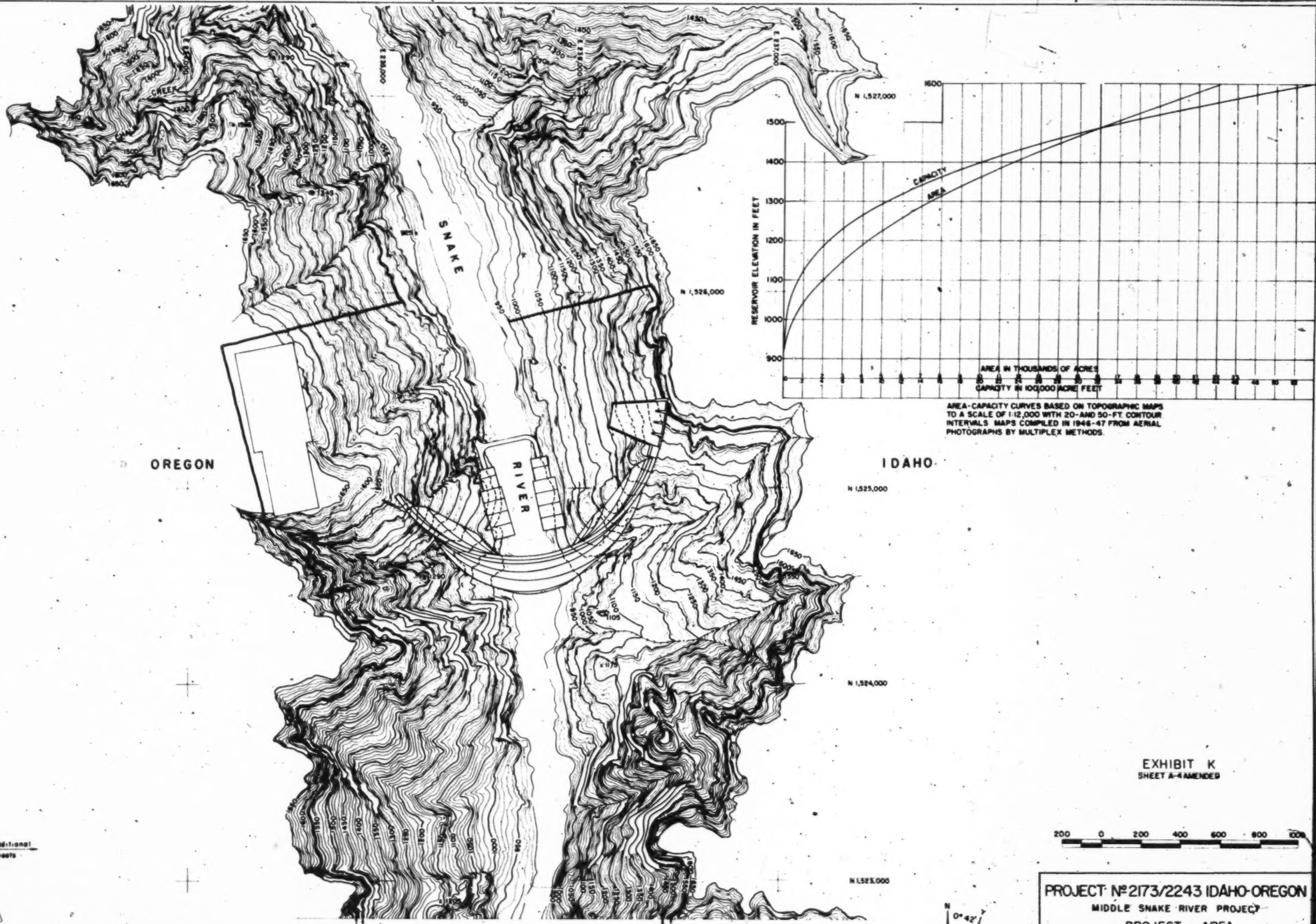
## (Amended)

### Detailed Maps of Project Area

The detailed maps of the project area, following, include, on Sheef A-4, the principal project structures. The project structures shown on Sheets 2 and 46 are to be disregarded, as are the reservoir area and capacity curve tables shown on Sheets 1 and 46.

Sheets 1 to 87 also show ownerships within the project area, keyed to detailed descriptions in Exhibit F. Where ownerships are not indicated, lands are United States lands.

Indications on all Exhibit K maps of project boundaries, minimum and maximum pool levels, are to be disregarded. The project boundary at the dam site is shown on Sheet A-4, Amended. Otherwise the project boundary above the site is established at contour level 1585, approximately 75 feet above normal full pond level of 1510. Maximum operating pool is established at contour level 1510, and normal minimum pool is established at contour level 1382.


SNAKE
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E 2,332,000
E 2,333,000
RESERVOIR ELEVATION IN FEET
CAPACITY
AREA
AREA IN THOUSANDS OF ACRES
CAPACITY IN 100,000 ACRE FEET
AREA-CAPACITY CURVES BASED ON TOPOGRAPHIC MAPS TO A SCALE OF 1:12,000 WITH 20-AND 50-FT. CONTOUR INTERVALS MAPS COMPILED IN 1946-47 FROM AERIAL PHOTOGRAPHS BY MULTIPLEX METHODS.
EXHIBIT K
SHEET A-4 AMENDED
200 0 200 400 600 800 1000
Index to Sheets
Additional Sheets
MAXIMUM OPERATING POOL
PROJECT BOUNDARY EL. 1865
Scale 1" = 200'
Contour interval-10'
USC &GS MEAN SEA LEVEL DATUM, 1929 ADJUSTMENT
1000' GRID based on IDAHO (WEST) RECTANGULAR
Compiled from U.S.C.E. drawing Sk-189-1
I certify that I supervised the survey of the project lands, that it is correct and accurate, and is correctly shown on the map.
March 10, 1958
Ernest W. Fehr Jr.
Ernest W Fehr Jr. was employed by the applicant to make the survey shown on above
N 0° 42' E
PROJECT Nº 2173/2243 IDAHO-OREGON
MIDDLE SNAKE RIVER PROJECT
PROJECT AREA
SCALE : 1" = 200'
PACIFIC NORTHWEST POWER COMPANY
SPOKANE, WASH. PORTLAND, ORE.

[fol. 25426]

BEFORE THE

FEDERAL POWER COMMISSION

Project No. 2243

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In the Matter of

PACIFIC NORTHWEST POWER COMPANY

---

AMENDED PETITION FOR LEAVE TO INTERVENE—
Filed December 3, 1959

National Hells Canyon Association, Inc. and Northwest Public Power Association hereby amend their Petition for Leave to Intervene, dated April 18, 1958, to read as follows:

Comes now National Hells Canyon Association, Inc. and Northwest Public Power Association, Interveners in Project No. 2173, and respectfully petition the Federal Power Commission for leave to intervene in the captioned matter pursuant to §308(a) of the Federal Power Act and §1.8 of the Commission's Rules and Regulations for the purpose of opposing the application in this proceeding, as amended September 23, 1959.

The filing of this petition has been duly authorized by your petitioners.

Statements descriptive of your petitioners are contained in the second paragraph of their petitions for leave to intervene in Project No. 2173, dated respectively October 27, 1955 and May 29, 1956, and are incorporated herein by reference.

[File endorsement omitted]

[fol. 25427] As grounds for intervention, numbered paragraphs 1, 2, 8 and 9 of Petition for Leave to Intervene filed in Project No. 2173 by National Hells Canyon Association, Inc. and numbered paragraphs 2, 8 and 9 of Petition for Leave to Intervene filed in Project No. 2173 by Northwest Public Power Association, are incorporated herein by reference. As additional ground for intervention, your petitioners allege that the application flies in the face of the Commission's decision in Project No. 2173, reaffirmed by the opinion and order on rehearing, issued April 11, 1958, and is therefore incompatible with the public interest in comprehensive development and utilization of the water resources involved, especially the development of storage for flood control, power production and other purposes.

Your petitioners therefore request the right to intervene for the purpose specified above and to seek from the Commission such order or other relief as may be appropriate pursuant to law or discretion vested in the Commission.

National Hells Canyon Association, Inc., Northwest Public Power Association, By: Evelyn N. Cooper, 1025 Connecticut Ave., N. W., Washington 6, D. C., Attorney for Petitioners.

Washington, D. C., December 3, 1959.

[fol. 25428] Subscribed and sworn to before me this 3rd day of December, 1959.

Lucy L. Allen, Notary Public, D. C.

(Seal)

Certificate of Service (omitted in printing).

[fol. 25429]

BEFORE THE

FEDERAL POWER COMMISSION

Project No. 2243

---

In the Matter of

PACIFIC NORTHWEST POWER COMPANY

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AMENDED MOTION TO DISMISS APPLICATION—
Filed December 3, 1959

National Hells Canyon Association, Inc. and Northwest Public Power Association hereby amend their Motion to Dismiss Application, dated April 18, 1958, to read as follows:

National Hells Canyon Association, Inc. and Northwest Public Power Association, Petitioners for Intervention herein, move that the application in this proceeding, as amended September 23, 1959, be dismissed forthwith, for the reason that it raises for readjudication the issue already adjudicated in Project No. 2173 (Opinion No. 307).

The application is for "a license under the Federal Power Act to authorize the construction, operation and maintenance of the Middle Snake River Project, comprising the project works as more fully described hereinafter [namely, a high Mountain Sheep project], as shall be, in the judgment of the Commission, best adapted to a comprehensive development of that portion of the Columbia River System beginning at a point approximately at the confluence of the Salmon and Snake Rivers in the States of [fol. 25430] Oregon and Idaho and extending upstream

[File endorsement omitted]

thereof, said reach being sometimes designated herein as the "Middle Snake River" (Amd. App. Lic., p. vii (1)). In Project No. 2173, the Commission determined, and on motion for rehearing reaffirmed, that for the river reach involved the Nez Perce project alone could satisfy the statutory licensing standard. Thus, the Commission held that "any combination of projects [for the Middle Snake Basin] which includes Nez Perce is consistently superior to any combination of projects which does not include Nez Perce", and, further, that "Nez Perce, together with existing storage and that under construction in the Snake Basin above the mouth of the Salmon, would supply all the storage needed to control the flows of the Salmon and the Middle Snake River above the Nez Perce site for the prevention of flood damage downstream on the Columbia, for economic power development and for other beneficial public purposes" (Op. No. 307, p. 6). The application presents nothing that detracts from the outstanding superiority of the Nez Perce project, either by comparison with its proposed high Mountain Sheep project or by comparison with that project in combination with a hypothetical Lower Canyon project on the Salmon River. In these circumstances, it would be utterly wasteful for the Commission to readjudicate the [fol. 25431] issue as to whether or not the Nez Perce project is "best adapted to a comprehensive plan for improving or developing a waterway or waterways . . . ", within the meaning of Section 10(a) of the Federal Power Act.

In thus amending their Motion to Dismiss Application, Petitioners do not waive their contention that the application is improperly made pursuant to the preliminary permit issued to Applicant in Project No. 2173 (see Amd. Applic., p. vii (1)). Nor do Petitioners waive their further contention that the application cannot properly be deemed an application for alternative, mutually inconsistent projects, there still being an intimation that it is intended to be broad enough to constitute an application for a license to construct the Nez Perce project as an alternative to the high

Mountain Sheep project, should a license for the latter be denied (*ibid.*).

Respectfully submitted,

Evelyn N. Cooper, 1025 Connecticut Ave., N. W., Washington 6, D. C., Attorney for Petitioners.

Washington, D. C., December 3, 1959.

[fol. 25432] Subscribed and sworn to before me this 3rd day of December, 1959.

Lucy L. Allen, Notary Public, D. C.

(Seal)

Certificate of Service (omitted in printing).

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[fol. 25919]

BEFORE THE

DEPARTMENT OF CONSERVATION AND DEVELOPMENT

DIRECTOR OF CONSERVATION AND DEVELOPMENT

STATE OF WASHINGTON

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In the Matter of the Application of Seventeen Public Utility Districts for the Formation of an Operating Agency Under RCW Chapter 43.52.

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FINDINGS AND ORDER RELATING TO OPERATING AGENCY TO BE KNOWN AS WASHINGTON PUBLIC POWER SUPPLY SYSTEM—January 31, 1957

An application was filed in the office of the Director of Conservation and Development on October 8, 1956, for the creation of an operating agency pursuant to RCW Chapter 43.52 for the purpose of acquiring, constructing, operating

and owning plants, systems and other facilities and extensions thereof for the generation and/or transmission of electric energy and power, to be known as the Washington Public Power Supply System. This application was executed by seventeen county-wide public utility districts, namely: each of the public utility districts named "Public Utility District No. 1 of ..... County" located in each of the following counties:

| | |
|---|---|
| Benton | Grays Harbor |
| Chelan | Kittitas |
| Clallam | Klickitat |
| Clark | Lewis |
| Douglas | Okanogan |
| Ferry | Skamania |
| Franklin | Snohomish |

also, Public Utility District No. 2 of Pacific County, Public Utility District No. 2 of Grant County, and Public Utility District No. 3 of Mason County. This application was [fol. 25920] made to the Director of Conservation and Development after the enactment by the legislative body of each of said districts to be initial members thereof authorizing said district to participate. Such application sets forth (1) the name and address of each participant, together with a certified copy of the enactment authorizing its participation; (2) a general description of the project and the principal project works, including dams, reservoirs, power houses and transmission lines; (3) the general location of the project and the name of each stream upon which such proposed project is to be located; (4) the proposed use or market for the power to be developed; (5) a general statement of the electric loads and resources of each of the participants, and (6) a statement of the proposed method of financing the preliminary studies and the participation therein by each of the participants.

Within ten days after such application was filed with the Director of Conservation and Development notice thereof was published once a week for four consecutive

weeks in newspapers of general circulation in the counties in which such project is located, setting forth the names of the participants and the general nature, extent and location of the project.

No public utility has objected to such application by filing any objection with the Director of Conservation and Development.

The Director of Conservation and Development having examined such application and being fully advised in the premises, does now make the following.

## Findings

1. The statements set forth in said application are substantially correct.

[fol. 25921] 2. The contemplated project is such as is adaptable to the reasonably foreseeable requirements of the members. No other public utility has indicated any intention by contract or by letter of intent to participate in the use of such project.

3. No other public utility objects to the formation of such operating agency.

4. Adequate provision has been and will be made for financing the preliminary engineering, legal and other costs necessary thereto.

Therefore, the Director of Conservation and Development now

## Orders

1. That such operating agency is hereby created as a municipal corporation and operating agency of the State of Washington for the purpose of acquiring, constructing, operating and owning plants, systems and other facilities and extensions thereof for the generation and/or transmission of electric energy and power and for such other purposes as may be provided by law and authorized by the members of this operating agency pursuant thereto.

2. The name of this operating agency is hereby established as: "Washington Public Power Supply System".

3. The specific project for construction and operation for which this operating agency is formed shall be the construction of a system of works, plants and facilities for the generation and transmission of electricity to provide a dependable source of power supply for the participants, consisting of the principal project works, including dams, reservoirs, power houses and transmission lines set forth in Exhibit A attached to this Order, which is made by this reference a part hereof.

[fol. 25922] Made and entered at Olympia, Washington, this *31st* day of *January* 1957.

Earl Coe, Director, Department of Conservation and Development, 335 General Administration Building, Olympia, Washington.

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[fol. 26132]

UNITED STATES OF AMERICA

FEDERAL POWER COMMISSION

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Project No. 2243

Pacific Northwest Power Company

---

Project No. 2273

Washington Public Power Supply System

---

MOTION TO VACATE ORDERS OF INTERVENTION—
Filed October 3, 1960

Northwest Public Power Association hereby moves the Federal Power Commission, pursuant to Rule 1.13 of the

[File endorsement omitted]

Rules and Regulations of the Commission, to vacate the orders issued by the Commission on March 3, 1960 and August 16, 1960, granting it leave to intervene in the above-entitled matters, and in support hereof states as follows:

1. Intervener co-petitioned with National Hells Canyon Association, Inc. for leave to intervene in Project No. 2243 on April 18, 1958, and in Project No. 2273 on July 6, 1960. These petitions were granted February 3, 1960 and August 16, 1960, respectively.

2. Subsequent to the granting of such petitions, a substantial part of Intervener's membership has become directly involved in Project No. 2273 through Washington Public Power Supply System.

3. Subject to the possible need to participate in specific aspects of this proceeding as a protestant (pursuant to [fol. 26133] Rule 1.10 et seq. of the Commission's Rules of Practice and Procedure) on behalf of all or part of its member utility systems, the interest of its membership in opposing the license application in Project No. 2243 and supporting the license application in Project No. 2273 will therefore be adequately represented by Washington Public Power Supply System, Applicant in the latter matter.

Respectfully submitted,

(Mrs.) Evelyn N. Cooper, Attorney for Intervener.

October 3, 1960
Washington, D. C.

[fol. 27301]

BEFORE THE

FEDERAL POWER COMMISSION

Project No. 2243

Project No. 2273

Consolidated Proceeding

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In the Matter of

PACIFIC NORTHWEST POWER COMPANY
WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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JOINT EXHIBIT

INTRODUCTORY MATERIAL

• • • • • • •

[fol. 27306] *Part C—Background of Proceedings*

• • • • • • •

[fol. 27309] 4. *Jurisdiction*

The Commission, in its decision of August 4, 1955, *In the Matter of Idaho Power Company* (14 FPC 55, at page 72) found the Snake River from its junction with the Columbia River up to the mouth of Henry's Fork (at about river mile 868) a navigable water of the United States. This finding was not disturbed by the U. S. Court of Appeals (See 237 F2d 777 C.A.D.A., cert. den. 353 U.S. 924). Consequently, under Section 23(b) of the Federal Power Act, a license is required for construction, operation or maintenance by either Applicant of the Nez Perce or the High Mountain Sheep Project, each of which would be located in the navigable reach of the Snake River. In addition, these proposed projects would occupy lands of the United States.

5. *Middle Snake River*

The term "Middle Snake River" appears throughout the record. In Column I, page 364 of the Report by the Division Engineer, U. S. Army Engineer Division, North Pacific, to the Chief of Engineers, United States Army dated June 1958, the term Middle Snake River is used to include the portion of the Snake River and its tributaries between Lewiston, Idaho and Weiser, Idaho. Going upstream from Lewiston the major tributaries are the Grande Ronde, the Salmon, the Imnaha, the Powder and the Burnt Rivers. Excluding the Grande Ronde River, which enters the Snake River below the China Gardens site, this subbasin has an area of about 19,500 square miles, or slightly over 8 percent of the Columbia River drainage above The Dalles and combined with the Upper Snake Basin above [fol. 27310] Weiser represents approximately 38 percent of the drainage area above The Dalles. The Middle Snake Basin has extremely rough terrain and comparatively inaccessible and sparsely populated areas consisting of eroded canyons through mountainous country. A stretch of approximately 100 miles downstream from Weiser, Idaho is commonly referred to as "Hells Canyon." Elevations vary from 715 (m.s.l.) at Lewiston to about 12,000 (m.s.l.) at the head waters of the Salmon River with some parts of the canyons being approximately 1,000 feet deep.

This Report, at page 364 Volume I, further states that the combined Middle and Upper Snake Basins contribute an estimated 17 percent of the run-off at The Dalles. Based on records of stream flow from 1910 to 1955, the mean discharge at the Nez Perce site just below the confluence of the Snake and Salmon Rivers is estimated at 30,600 cfs with the maximum and minimum mean monthly flow being indicated at 115,000 cfs in May 1928 and 9,200 cfs in September 1924. The flow at this site for the greatest known flood in 1894 is estimated at 250,000 cfs.

• • • • • • •

[fol. 27312] *Part D—Corps of Engineers' Report on the Columbia River Basin*

The Corps of Engineers by resolution of the Committee on Public Works of the United States Senate, dated July 28, 1955, had undertaken to conduct a review of its report on the development of the Columbia River and its tributaries which had been published as House Document 531, 81st Congress, 2nd Session. In the late fall of 1955 the Corps announced that it was extending its review to include the Middle Snake River area, specifically to examining the possibilities of development with either the Nez Perce or High Mountain Sheep projects.

In September of 1958 the Report of the Division Engineer, North Pacific Division, U. S. Army entitled "Water Resources Development of the Columbia River Basin" was released. This report bears the date of June 1958 and is sometimes hereinafter referred to as the "Division Engineer's Report." The report and recommendation so far as here pertinent, were reviewed and approved by the Board of Engineers for Rivers and Harbors in a letter report dated June 5, 1959, with recommendation that the pool level of a project in the Middle Snake River be raised from elevation 1490 as recommended in the Division Engineers' Report, to something in the order of elevation 1510. With some modifications, letter report first released January 9, 1960 and revised under date of March 31, 1961 of the Chief of Engineers, U.S. Army also approved the report and recommendations as approved by the Board of Engineers.

[fol. 27313] *Part E—Future Power Potential in the Northwest Area*

As of the date of this proceeding, there are existing, under construction or licensed hydroelectric plants with a total nameplate rating of 16,900,000 kilowatts, with an Average Prime Energy (based on the present critical period) of about 9,400,000 kilowatts and approximately 11,800,000 kilowatts of average annual energy.[1] There is

[1] Table 6, PNPC Exhibit 17, less High Mountain Sheep, Muddy, Eden Ridge, Meadows and Little White Salmon plus Boundary

presently installed 465,000 kw of thermal capacity, a substantial part of which is obsolete and high cost, and held only as emergency reserve.

The Division Engineer's Report indicates an eventual hydro installation approximating 36,000,000 kilowatts of capacity and 16,900,000 kilowatts of average annual energy (Figure 12, p. 51, Table 54). The plants included in the Major Water Plan, as recommended, (or their equivalent) would provide approximately 3,179,000 kilowatts[2] of installed capacity. These plants will have nearly 4,000,000 kw of Prime Energy and about 2,675,000 kw of average annual energy (Table 52, p. 387, Volume I).

[fol. 27314] Completion of 15,500,000 acre feet of storage at Mica Creek, Arrow and Duncan Lakes as provided by the proposed treaty would during the early years create approximately 750,000 kw of average annual energy (U. S. entitlement). Ultimately this amount is expected to decrease to approximately 450,000 kw of average annual energy.

Together the existing projects, added plants included in the Major Water Plan (or their equivalent) and the Canadian Storage Development will account for approximately 15¼ million kw of average annual energy of the potential 16.9 million as estimated by the Division Engineer. The remaining kilowatts of approximately 1¾ million of average annual energy will be largely obtained from the large group of mostly smaller projects of relatively high costs (Table 49, p. 382, Volume I).

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(600,000 kw peak, 407,000 kw Prime Energy). Not included in the figures are installed capacities for Lower Granite (360,000 kw) and Little Goose (360,000 kw) on the Snake River which are authorized for federal construction but for which no construction funds have been appropriated.

[2] This figure includes installed capacity at the following projects of the Major Water Plan: Libby (344,000 kw), Long Meadows (9,000 kw), Nine Mile Prairie (60,000 kw), Knowles (256,000 kw), Enaville (30,000 kw), Garden Valley (286,000 kw), High Mountain Sheep (600,000 kw), Lower Canyon (640,000 kw), Asotin (288,000 kw), Wenaha (134,000 kw), Penny Cliffs (292,000 kw) and Bruces Eddy (240,000 kw).

The Northwest will thus continue as a hydro system for some years in the future. However, major thermal units are expected to be installed while hydroelectric projects are still under construction and planned. Further, after the practical limit of development of hydroelectric energy is reached, there will be installations at existing plants of additional generating units for peaking (some new high-head hydroelectric plants may be developed in the same period for peaking and, depending on fuel costs, pump storage units may be installed to expand hydro peaking potential).

Figure 12 of the Division Engineer's Report, estimates the hydro energy potential to be realized about 1985, and the hydro peaking potential to be realized sometime after the year 2000. Whatever the time period, there will be a transitional period from the all hydro system to a "mature" [fol. 27315] hydro-thermal system.

The "transitional period" is the period that starts approximately when major modern thermal installations are made. It ends and the "mature hydro-thermal period" begins approximately when sufficient steam plant installations have been made so that the nominal prime output of the hydro projects is no longer the controlling factor in the establishment of load carrying capability of the system.

During the transitional period, there will be less withdrawal of storage in hydro plants in order to increase annual generation useable for fuel saving at thermal plants. Also, as thermal is installed, the storage control period will be shortened by a few weeks at its beginning and end. Plants will be evaluated by their prime energy, average annual energy and peaking capability, with average annual energy increasing in relative importance as a greater amount becomes useable.

In the "mature" hydro-thermal system, storage in hydro plants will be operated so as to obtain maximum useable peaking and maximum annual average generation. The

general effect will be to substantially reduce the amount of storage used for power to the minimum required to catch spring run-offs; use of storage will be concentrated in plants farthermost upstream; downstream plants will release little, if any, storage—generally restricted to overlap storage. Hydro plants will be generally evaluated by their peaking and average annual energy capability, and the system will operate on a short storage control period (6-17 months).

[fol. 27316] *Part F—Northwest Power Pool*

The Northwest Power Pool is a voluntary arrangement among thirteen utilities of the Pacific Northwest area for the coordination of the operation of the affected systems. Participating utilities include all utilities that have major hydroelectric facilities in the Northwest.

The participants consist of: Puget Sound Power & Light Company, Pacific Power & Light Company, Portland General Electric Company, The Washington Water Power Company, The Montana Power Company, Idaho Power Company, Utah Power & Light Company, Bonneville Power Administration, Seattle City Light, Tacoma City Light and Chelan County PUD. A member in associate status is Grant County PUD. The remaining member of the Pool is the British Columbia Electric Company which has recently been made a Crown Corporation.

The Pool operates through an operating committee consisting of the chief operating engineers of the various utilities. In accordance with a statement of principles and under the direction of the operating committee each year in advance of the storage control season an operating program is drawn up. The objective is to achieve by coordination the maximum production of useable energy and peaking in the Power Pool as a whole. The operating program is subject to approval by the utilities involved. Such approval is necessarily conditional upon the willingness and contractual ability of individual utilities to so operate

their facilities in view of whatever inter-utility compensa-
[fol. 27317] tion is available.[1]

Pool operation requires coordination of facilities and appropriate provision for inter-utility compensation. Existing contractual arrangements among different utilities cover some portions of these arrangements and, as noted below, a general coordination agreement for an initial term of one year, has recently been executed. There are now in existence a series of individual agreements for interchange, load factoring, coordination of facilities, wheeling and other services. The most important of these are: the coordination agreement between the Cities of Seattle and Tacoma; the "ICP" contract which includes Puget Sound Power & Light Company, Pacific Power & Light Company, Portland General Electric Company and The Washington Water Power Company; an integration agreement among The Washington Water Power Company, Pacific Power & Light Company and Idaho Power Company; and power sales agreements and interchange agreements between Bonneville Power Administration and several utilities. In addition to those specifically listed above, a number of other agreements exist among the several utilities of the Pool.

The expenses of the operation of the Northwest Power Pool are divided among the members in accordance with an agreement among them. Such expenses include labor, office rent, office supplies, and travel communications expense, but do not include other costs of coordinating operations such as charges for wheeling, standby and rental of
[fol. 27318] facilities. The latter items of cost are subject to negotiation by the parties involved as a part of the basic inter-utility agreements. A coordinating engineering group is maintained in Portland, Oregon. This group works under the operating committee and is responsible for com-

[1] It is noted that WPPSS considers that there are limitations to the effectiveness with which the operating program is carried out.

piling the operating program and other coordination and operational duties.

In September 1961, a coordination agreement for a term of one year only was signed by the members of the Power Pool (except the Cities of Seattle and Tacoma, Idaho, Utah and B.C. Electric). The agreement may have the effect during the term thereof of modifying the organization by which the Pool carries out its functions, and will increase the effectiveness of coordination of facilities among the parties signing the agreement. The agreement is intended as a pilot plan and it is anticipated that it may result in execution of a long term coordination agreement which would include all of the major owners and operators of generating facilities in this area.

MIDDLE SNAKE RIVER BASIN
COMPREHENSIVE DEVELOPMENT STUDIES
COMPARISON OF PROJECT PHYSICAL DATA

Joint Exhibit Part G - Sheet 1 of 3

| | | High Mountain Sheep Plan | | | | | | Nez Perce Plan | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | China Gardens | | High Mountain Sheep | | Lower Canyon | | China Gardens | | Nez Perce | | Whitebird | |
| GENERAL | Unit | PNPC Elev 945 | WPPSS Elev 925 | PNPC | WPPSS | PNPC | WPPSS | PNPC Elev 920 | WPPSS Elev 905 | PNPC | WPPSS | PNPC | WPPSS |
| River | River | Snake | | Snake | | Salmon | | Snake | | Snake | | Salmon | |
| River Mile | Miles | 172.5 | 172.5 | 189.2 | 189.2 | 3.7 | 0.5 | 172.5 | 172.5 | 186.2 | 186.2 | 58.8 | 59.8 |
| Normal Pool Elevation | Ft-MSL | 945 | 925 | 1,510 | 1,510 | 1,595 | 1,595 | 920 | 905 | 1,510 | 1,510 | 1,575 | 1,570 |
| Normal Tailwater (Avg.) | Ft-MSL | 845 | 845 | 940 | 925 | 940 | 925 | 845 | 845 | 915 | 903 | 1,475 | 1,490 |
| Maximum Hydraulic Head | Feet | 105 | 85 | 580 | 608 | 665 | 698 | 80 | 65 | 605 | 635 | 100 | 80 |
| Maximum Drawdown Pool Elev. | Ft-MSL | | | 1,212 | 1,212 | 1,270 | 1,270 | | | 1,210 | 1,210 | | |
| STORAGE | | | | | | | | | | | | | |
| Gross Storage Volume | M Acre-Ft | Pondage | Pondage | 3,600 | 3,600 | 3,820 | 4,060 | Pondage | Pondage | 6,600 | 6,600 | Pondage | Pondage |
| INITIAL POWER INSTALLATION | | | | | | | | | | | | | |
| Number of Units | Each | 3 | 3 | 7 | 6 | 4 | 4 | 3 | 3 | 11 | 10 | 1 | 3 |
| Total Nameplate Rating | Mw | 255 | 205 | 1,225 | 1,200 | 700 | 912 | 195 | 190 | 1,815 | 2,000 | 52 | 65 |
| Total Maximum Capability | Mw | 300 | 234 | 1,400 | 1,313 | 800 | 975 | 225 | 201 | 2,090 | 2,235 | 60 | 69 |
| ULTIMATE POWER INSTALLATION | | | | | | | | | | | | | |
| Number of Units | Each | 5 | | 10 | 10 | 7 | 6 | 5 | | 17 | 16 | 3 | 3 |
| Total Nameplate Rating | MW | 425 | | 1,750 | 2,000 | 1,225 | 1,368 | 325 | | 2,805 | 3,200 | 156 | 65 |
| Total Maximum Capability | MW | 500 | | 2,000 | | 1,400 | | 375 | | 3,230 | | 180 | |
| OTHER DATA | | | | | | | | | | | | | |
| Maximum Design Flood | Cfs | 500,000 | 500,000 | 300,000 | 300,000 | 245,000 | 245,000 | 500,000 | 500,000 | 500,000 | 500,000 | 245,000 | 245,000 |
| Turbine Design Head | Feet | 85 | | 550 | 550 | 550 | 640 | 60 | | 530 | 570 | 90 | 79 |
| Max. Turbine Output at Rated Head | Hp | 143,000 | | 285,000 | 290,000 | 285,000 | 330,000 | 107,000 | | 271,000 | 290,000 | 86,000 | 30,000 |
| Generator Rating - 60 C Rise | Mw | 85 | 68.3 | 175 | 200 | 175 | 228 | 65 | 56.6 | 165 | 200 | 52 | 22 |
| 80 C Rise | Mw | 100 | 78.6 | 200 | 230 | 200 | 262 | 75 | 67.1 | 190 | 230 | 60 | 25 |
| Turbine Intake Elevation - (centerline) | Ft-MSL | | | 1,160 | 1,115 | 1,170 | 1,165 | | | 1,160 | 1,125 | | |
| Turbine Type | | Kaplan | Kaplan | Francis | Francis | Francis | Francis | Kaplan | Kaplan | Frnacis | Francis | Kaplan | Kaplan |

Joint Exhibit Part G - Sheet 1 of 3
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MIDDLE SNAKE RIVER BASIN
COMPREHENSIVE DEVELOPMENT STUDIES
COMPARISON OF PROJECT PHYSICAL DATA

Joint Exhibit Part G - Sheet 2 of 3

| | | High Mountain Sheep Plan | | | | | | Nez Perce Plan | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | China Gardens | | High Mountain Sheep | | Lower Canyon | | China Gardens | | Nez Perce | | Whitebird | |
| | Unit | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS |
| Normal Pool Elevation | Ft-Msl | 945 | 925 | 1510 | 1510 | 1595 | 1595 | 920 | 905 | 1510 | 1510 | 1575 | 1570 |
| **HYDROLOGY** | | | | | | | | | | | | | |
| Drainage Area | M sq-mi | 88.8 | 88.8 | 74.7 | 74.7 | 13.95 | 14 | 88.8 | 88.8 | 88.7 | 88.7 | 13.5 | 13.5 |
| Mean Annual Discharge | M cfs | 30.6 | 30.6 | 19.6 | 19.6 | 10.9 | 10.9 | 30.6 | 30.6 | 30.6 | 30.6 | 10.8 | 10 |
| | M acre-ft. | 22,200 | 22,200 | 14,200 | 14,200 | 7,900 | 7,900 | 22,200 | 22,200 | 22,200 | 22,200 | - | - |
| Max. Avg. Ann. Discharge | M cfs | 44 | 44 | 28.1 | 28.1 | 15.9 | 15.9 | 44 | 44 | 44 | 44 | 15.8 | 15.8 |
| | M acre-ft. | 31,800 | 31,800 | 20,400 | 20,400 | 11,500 | 11,500 | 31,800 | 31,800 | 31,800 | 31,800 | 11,480 | 11,480 |
| Min. Avg. Ann. Discharge | M cfs | 17.3 | 17.3 | 11.5 | 11.5 | 5.8 | 5.8 | 17.3 | 17.3 | 17.3 | 17.3 | 5.8 | 5.8 |
| | M acre-ft. | 12,500 | 12,500 | 8,300 | 8,300 | 4,200 | 4,200 | 12,500 | 12,500 | 12,500 | 12,500 | 4,200 | 4,200 |
| Greatest Known Discharge | M cfs | 250 | 250 | 135 | 135 | 123 | 123 | 250 | 250 | 250 | 250 | 120.5 | 120.5 |
| Design Flood | M cfs | 500 | 500 | 300 | 300 | 245 | 245 | 500 | 500 | 500 | 500 | 245 | 245 |
| **GENERAL** | | | | | | | | | | | | | |
| Project Location | River Mile | Snake 172.5 | Snake 172.5 | Snake 189.2 | Snake 189.2 | Salmon 3.7 | Salmon 0.5 | Snake 172.5 | Snake 172.5 | Snake 186.2 | Snake 186.2 | Salmon 58.8 | Salmon 59.8 |
| Length of Reservoir | miles | 16.7 | 16.7 | 58 | 58 | 72.8 | 76 | 13.7 | 13.7 | 61 to Hell's C<br>61 to Whtbd | | 14.7 | 14.7 |
| Pool Area Max. Pool Elev. | acres | 2,200 | - | 17,700 | - | 17,000 | - | 1,650 | - | 31,500 | - | 2,800 | - |
| Land Acquisition | acres | 3,000 | - | 20,000 | - | 19,000 | - | 2,250 | - | 36,000 | - | 5,000 | - |
| Reservoir Cap. - Normal Pool | M acre-ft. | 71 | - | 3,600 | - | 3,820 | 4,060 | 52 | - | 6,600 | - | | - |
| **PROJECT DIMENSIONS** | | | | | | | | | | | | | |
| Gross Head | feet | 100 | 80 | 570 | 586 | 655 | 670 | 75 | 60 | 595 | 607 | 100 | 80 |
| Top of Dam Elev. | ft-Msl | 957.5 | 935 | 1,520 | 1,520 | 1,605 | 1,605 | 932.5 | 915 | 1,520 | 1,520 | 1,585 | 1,575 |
| Crest Length | feet | 1,500 | - | 1,460 | 1,460 | 1,520 | 2,400 | 1,350 | 1,350 | 1,270 | 1,550 | 975 | 1,050 |
| Spillway Crest Elev. | ft-Msl | 892.5 | - | 1,460 | 1,454 | 1,558 | 1,550 | 867.5 | - | 1,465 | 1,230 | 1,537.5 | 1,533 |
| Max. Reservoir Elev. | ft-Msl | 955 | 925 | 1,517.5 | 1,510 | 1,602.5 | 1,595 | 930 | 905 | 1,517.5 | 1,510 | 1,582.5 | 1,570 |
| Spillway Capacity | M cfs | 500 | 500 | 245.5 | 250 | 164 | 170 | 500 | 500 | 380 | 380 | 245 | - |
| Spillway Gates | No. ft w x ft h | 5 - 50x52.5 | | 3 - 50x50 | 3 - 50x56 | 3 - 50x37 | 3 - 48x45 | 5 - 50x52.5 | | 5 - 50x45 | 7 - 16x30 | 4 - 50x37.5 | Louver Barrier |
| No. of Sluices | each | - | - | 4 over 4 | 7 | 5 over 6 | 12 | - | - | 10 over 10 | 12 | - | - |
| Sluice Capacity - Max. | M cfs | - | - | 54.5 | 50 | 81 | 76 | - | - | 120 | 120 | - | - |
| Sluice Cap./at Elev. | M cfs/ft-MSL | - | - | 47/1382 | 43/1382 | 51/1270 | 50/1304 | - | - | 94/1270 | 88/1310 | - | - |
| Comb. Discharge - Sluices & Units | M cfs | - | - | 47+18 | 43+23 | 51+10 | 50+11 | - | | 94+26 | 88+31 | - | - |
| Penstock Diameter | feet | - | - | 18 | 25/17 | 18 | 27/18 | - | - | 1-18, 8-25 | 25/17 | - | - |
| | | | | | | | | | | | | - | - |
| **DIVERSION TUNNEL** | | | | | | | | | | | | | |
| Tunnel Equiv. Diameter | feet | - | - | 33 | 29 | 33 | 40 | - | - | 48 | 44 | | - |
| Diversion Capacity | M cfs | 70 | - | 42 | 42 | 40 | 97 (Rockfill Dam) | 70 | - | 96 | 90 | 40-25 | - |

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27320

MIDDLE SNAKE RIVER BASIN
COMPREHENSIVE DEVELOPMENT STUDIES
COMPARISON OF PROJECT PHYSICAL DATA

Joint Exhibit Part G - Sheet 3 of 3

| | Unit | High Mountain Sheep Plan | | | | | | Nez Perce Plan | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | China Gardens | | High Mountain Sheep | | Lower Canyon | | China Gardens | | Nez Perce | | Whitebird | |
| | | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS | PNPC | WPPSS |
| Normal Pool Elevation | ft.-msl | 945 | 925 | 1510 | 1510 | 1595 | 1595 | 920 | 905 | 1510 | 1510 | 1575 | 1570 |
| **POWERHOUSE EQUIPMENT** | | | | | | | | | | | | | |
| Turbines - Init, Fut, Ult | each | 3,5,5, | 3,5,5 | 7,8,10 | 6,10,10 | 4,5,7 | 4,6,6 | 3,5,5 | 3,5,5 | 11,13,17 | 10,16,16 | 1,2,3 | 3,3,3. |
| Turbine Rating - Max. Gate | hp | 143,000 | - | 285,000 | 290,000 | 285,000 | 330,000 | 107,000 | - | 271,000 | 290,000 | 86,000 | 30,400 |
| Turbine Net Head | feet | 85 | - | 550 | 550 | 550 | 640 | 60 | - | 530 | 570 | 90 | 79 |
| Turbine Speed | rpm | 90 | - | 150 | 163.6 | 150 | 180 | 72 | - | 150 | 163.6 | 112.5 | 171.5 |
| Generator Rating | kva | 90,000 | 71,930 | 184,000 | 210,000 | 184,000 | 240,000 | 69,000 | 59,650 | 174,000 | 210,000 | 55,000 | 23,000 |
| Generator Output @ 0.95 pf | kw | 85,000 | 68,333 | 175,000 | 200,000 | 175,000 | 228,000 | 65,000 | 56,667 | 165,000 | 200,000 | 52,000 | 21,900 |
| Gen. Max. Output @ 0.95 pf | kw | 100,000 | 78,583 | 200,000 | 230,000 | 200,000 | 262,000 | 75,000 | 65,167 | 190,000 | 230,000 | 60,000 | 25,000 |
| **POWERHOUSE DIMENSIONS** | | | | | | | | | | | | | |
| Turbine Distributor Elev. | ft-MSL | 835 | | 915 | 894 | 932 | 891 | 846 | | 902 | 871 | 1,467 | 1,470 |
| Operating Floor Level | ft-MSL | 852 | - | 927 | 943 | 944 | 940 | 864 | | 915 | 919 | 1,485 | 1,498 |
| Roof Deck Level | ft-MSL | 870 | - | 945 | 1,008 | 962 | 1,005 | 882 | | 930 | None | 1,501 | 1,556 |
| Max. Flood Protection Level | ft-MSL | 870 | | 960 | 976 | 980 | 975 | 882 | | 945 | 976 | 1,515 | 1,515 |

Joint Exhibit Part G - Sheet 3 of 3
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27321

[fol. 27326] *Part I—Tables of Power Potentials—Alternative Plans of Development*

The attached Tables 1 through 5 (each Table consisting of two sheets) set forth the power potentials of the alternative plans of development under ten different assumptions which affect power potential figures in the Middle Snake River. Table 6 summarizes the preceding tables. Table 7 summarizes certain pertinent plant physical data. These assumptions relate to levels of development, Canadian storage and existence or non-existence of projects in or above the "common reach".

There are two major assumptions as to the size of the total hydroelectric system:

*Initial Period*—System power development of approximately 16,000,000 kw assumed prevailing when either High Mountain Sheep or Nez Perce comes into service.

*Subsequent Period*—System power development of approximately 30,000,000 kw.

There are five alternate assumptions as to the existence of China Gardens, Whitebird and Freedom Projects in the "common reach", and the Crevice storage project upstream on the Salmon from the "common reach". These are:

(Initial Period)

*Table 1—Without* China Gardens, Whitebird, Freedom, Crevice.

*Table 2—With* China Gardens, *without* Whitebird, Freedom, Crevice. (Subsequent Period)

*Table 3—With* China Gardens, Whitebird, Freedom, *without* Crevice.

*Table 4—With* China Gardens, Whitebird, Freedom, Crevice.

*Table 5—With* China Gardens, *without* Whitebird, Freedom, Crevice.

[fol. 27327] Sheet 1 of each table shows the condition indicated *without* Canadian Storage; Sheet 2 shows the same condition *with* Canadian Storage.

The ten "conditions" are conditions analyzed by either PNPC or WPPSS, and the inclusion of the condition in the tables does not represent agreement that it is appropriate in this proceeding to analyze the alternative projects in light of such condition.

The alternative Plans of Development are:

*High Mountain Sheep Plan of Development*

High Mountain Sheep
Lower Canyon
China Gardens

*Nez Perce Plan of Development*

Nez Perce
Whitebird
China Gardens

Figures for High Mountain Sheep Project alone, without Lower Canyon (termed "High Mountain Sheep Plan" by WPPSS)—are shown on each table.

Freedom Project tailwater is differently affected by the different plans, and for that reason Freedom is shown (Hells Canyon, however, is not shown because the backwater effect on Hells Canyon has been "netted out" of figures for High Mountain Sheep and Nez Perce).

* * * * * * *

# TABLE I
## INITIAL PERIOD
(Common Reach Projects Except China Gardens, Whitebird & Freedom)
WITHOUT CANADIAN STORAGE



| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1937 4/ | |
|---|---|---|---|---|---|---|
| Nez Perce Plan - WPPSS & PNPC | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 1098 | 1087 | 1027 | 1015 | 1609 | 1925 |
| China Gardens - Elev. 915 | - | - | - | - | - | - |
| China Gardens - Elev. 905 | - | - | - | - | - | - |
| Common Reach Subtotal | 1098 | 1087 | 1027 | 1015 | 1609 | 1925 |
| Downstream Effect | | | | | | |
| Nez Perce | 375 | 398 | 135 | 125 | - | - |
| Total | 1473 | 1485 | 1162 | 1140 | 1609 | 1925 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** | | | | | | |
| **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 393 | - | 388 | - | 654 |
| Lower Canyon - Mile 0.5 | 423 | - | 407 | - | 580 | - |
| High Mountain Sheep (Net) | 762 | 766 | 647 | 646 | 1105 | 1344 |
| China Gardens - Elev. 940 | - | - | - | - | - | - |
| China Gardens - Elev. 925 | - | - | - | - | - | - |
| Common Reach Subtotal | 1185 | 1159 | 1054 | 1034 | 1685 | 1998 |
| Downstream Effect | | | | | | |
| Lower Canyon | 270 | 261 | 86 | 78 | - | - |
| High Mountain Sheep | 180 | 179 | 57 | 54 | - | - |
| Downstream Effect Subtotal | 450 | 440 | 143 | 132 | - | - |
| Total | 1635 | 1599 | 1197 | 1166 | 1685 | 1998 |
| **High Mountain Sheep Plan - WPPSS** | | | | | | |
| **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 776 | 761 | 645 | 626 | 1040 | 930 |
| China Gardens | - | - | - | - | - | - |
| Downstream Effect | 173 | 171 | 38 | 40 | - | - |
| Total | 949 | 932 | 683 | 666 | 1040 | 930 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mountain Sheep Including Lower Canyon | 162 | 114 | 35 | 26 | 76 | 73 |
| High Mountain Sheep Without Lower Canyon | (524) | (553) | (479) | (474) | (569) | (995) |

1/ Without Canadian Storage the critical period extends from Sept. 1, 1936 through April 30, 1937 except that data for High Mountain Sheep Project alone the critical period data are based on a 7-month period from Sept. 16, 1936 through April 15, 1937.

2/ WPPSS data are based on ULTIMATE INTEGRATED OPERATION. Data are taken from Sheet 1 WPPSS Exhibit 293.

3/ Data given in PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively, have been adjusted to exclude PNPC China Gardens Project.

4/ WPPSS data are based on end of January, 1937 and PNPC data are based on mid-January, 1937.

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Table I, Sheet 1 of 2

27329

[fol. 27330]

Table I - Sheet 2 of 2
WITH Canadian Storage

# TABLE I
## INITIAL PERIOD
## (Common Reach Projects Except China Gardens, Whitebird & Freedom)
## WITH CANADIAN STORAGE

| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1937 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 1048 | 1040 | 1027 | 1015 | 1609 | 1925 |
| China Gardens - Elev. 915 | - | - | - | - | - | - |
| China Gardens - Elev. 905 | - | - | - | - | - | - |
| Common Reach Subtotal | 1048 | 1040 | 1027 | 1015 | 1609 | 1925 |
| Downstream Effect | | | | | | |
| Nez Perce | 332 | 354 | 135 | 125 | - | - |
| Total | 1380 | 1394 | 1162 | 1140 | 1609 | 1925 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 371 | - | 388 | - | 654 |
| Lower Canyon - Mile 0.5 | 398 | - | 407 | - | 580 | - |
| High Mountain Sheep (Net) | 728 | 733 | 647 | 646 | 1105 | 1344 |
| China Gardens - Elev. 940 | - | - | - | - | - | - |
| China Gardens - Elev. 925 | - | - | - | - | - | - |
| Common Reach Subtotal | 1126 | 1104 | 1054 | 1034 | 1685 | 1998 |
| Downstream Effect | | | | | | |
| Lower Canyon | 240 | 232 | 86 | 78 | - | - |
| High Mountain Sheep | 160 | 159 | 57 | 54 | - | - |
| Downstream Effect Subtotal | 400 | 391 | 143 | 132 | - | - |
| Total | 1526 | 1495 | 1197 | 1166 | 1685 | 1998 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 742 | 741 | 645 | 626 | 1040 | 930 |
| China Gardens | - | - | - | - | - | - |
| Downstream Effect | 149 | 168 | 38 | 40 | - | - |
| Total | 891 | 909 | 683 | 666 | 1040 | 930 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 146 | 101 | 35 | 26 | 76 | 73 |
| High Mt. Sheep Without Lower Canyon | (489) | (485) | (479) | (474) | (569) | (995) |

1/ With Canadian Storage which assumes during the initial period that 8,500,000 acre-feet have been developed at Arrow and Duncan Lakes, the critical period extends from August 1, 1936 through April 30, 1937 except that data for the High Mountain Sheep Project alone the critical period data are based on an 8-month period from Sept. 1, 1936 through April 30, 1937.

2/ WPPSS data are based on ULTIMATE INTEGRATED OPERATION. Data are taken from Sheet 1 WPPSS Exhibit 293.

3/ Data given in PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively, have been adjusted to exclude PNPC China Gardens Project.

4/ WPPSS data are based on end of January, 1937 and PNPC data are based on mid-January, 1937.

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Table 1, Sheet 2 of 2

27330

[fol. 27331]

Table 1A

TABLE 1A
INITIAL PERIOD
(Common Reach Projects Except China Gardens, Whitebird, and Freedom)
Coordinated Operation 1/, Prior to Completion of 15,500,000 Acre-Feet of Canadian Storage

| | Nominal Prime Energy Avg. MW 7-month 2/ | Nominal Prime Energy Avg. MW 8-month 3/ | Nominal Prime Energy Avg. MW 9-month 4/ | Avg. Energy Generation Avg. MW 20 Years (1928 - 1948) 5/ | Plant Peak Capability MW January, 1937 5/ 6/ |
|---|---|---|---|---|---|
| **Nez Perce Plan - WPPSS & PNPC** | | | | | |
| Freedom | - | - | - | - | - |
| Whitebird | - | - | - | - | - |
| Nez Perce (Net) | 1090 | 1056 | 1011 | 1075 | 1850 |
| China Gardens - Elevation 915 | - | - | - | - | - |
| China Gardens - Elevation 905 | - | - | - | - | - |
| Common Reach Subtotal | 1090 | 1056 | 1011 | 1075 | 1850 |
| Downstream Effect | | | | | |
| Nez Perce | 285 | 249 | 222 | 106 | - |
| Total | 1375 | 1305 | 1233 | 1181 | 1850 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS<br>High Mountain Sheep Plan - PNPC** | | | | | |
| Freedom | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | - | - | - | - |
| Lower Canyon - Mile 0.5 | 382 | 363 | 345 | 429 | 820 |
| High Mountain Sheep (Net) | 747 | 728 | 696 | 653 | 1125 |
| China Gardens - Elev. 940 | - | - | - | - | - |
| China Gardens - Elev. 925 | - | - | - | - | - |
| Common Reach Subtotal | 1129 | 1091 | 1041 | 1082 | 1945 |
| Downstream Effect | | | | | |
| Lower Canyon | 189 | 165 | 147 | 65 | - |
| High Mountain Sheep | 118 | 104 | 92 | 41 | - |
| Downstream Effect Subtotal | 307 | 269 | 239 | 106 | - |
| Total | 1436 | 1360 | 1280 | 1188 | 1945 |
| **High Mountain Sheep Plan - WPPSS<br>Project No. 2243 Application - PNPC** | | | | | |
| Freedom | - | - | - | - | - |
| High Mountain Sheep (Net) | 739 | 693 | 667 | 653 | 1218 |
| China Gardens | - | - | - | - | - |
| Downstream Effect | 93 | 60 | 53 | 29 | - |
| Total | 832 | 753 | 720 | 682 | 1218 |
| **Difference: Nez Perce Plan To:** | | | | | |
| High Mt. Sheep Including Lower Canyon | 61 | 55 | 47 | 7 | 95 |
| High Mt. Sheep Without Lower Canyon | (543) | (552) | (513) | (499) | (632) |

1/ Data are taken from Sheet 1 of 2 WPPSS Exhibit 293 and reflect output of the respective WPPSS plans under Coordinated Operation as testified to by Witness Gallup. PNPC has no data which assumes such an operation.

2/ September 16, 1936 through April 15, 1937)
3/ September 1, 1936 through April 30, 1937 ) Represents conditions WITHOUT Canadian Storage

4/ August 1, 1936 through April 30, 1937 ) Represents condition with 8,500,000 acre-feet of Canadian Storage at Arrow and Duncan Lakes

5/ Data are the same WITH or WITHOUT Canadian Storage

6/ Peaking for end of month

27331

[fol. 27332]

TABLE 2
INITIAL PERIOD
(Common Reach Projects Except Whitebird & Freedom, but Including China Gardens)
WITHOUT CANADIAN STORAGE

Table 2 - Sheet 1 of 2
WITHOUT Canadian Storage

| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW 4/ January, 1937 | |
|---|---|---|---|---|---|---|
| | 2/ WPPSS Data | 3/ PNPC Data | 2/ WPPSS Data | 3/ PNPC Data | 2/ WPPSS Data | 3/ PNPC Data |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 1072 | 1043 | 1007 | 978 | 1609 | 1867 |
| China Gardens - Elev. 915 | - | 149 | - | 130 | - | 225 |
| China Gardens - Elev. 905 | 125 | - | 112 | - | 195 | - |
| Common Reach Subtotal | 1197 | 1192 | 1119 | 1108 | 1814 | 2092 |
| Downstream Effect | | | | | | |
| Nez Perce | 375 | 398 | 135 | 125 | - | - |
| Total | 1572 | 1590 | 1254 | 1233 | 1814 | 2092 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 386 | - | 381 | - | 645 |
| Lower Canyon - Mile 0.5 | 418 | - | 403 | - | 580 | - |
| High Mountain Sheep (Net) | 751 | 733 | 638 | 618 | 1105 | 1294 |
| China Gardens - Elev. 940 | - | 208 | - | 176 | - | 300 |
| China Gardens - Elev. 925 | 175 | - | 149 | - | 236 | - |
| Common Reach Subtotal | 1344 | 1327 | 1190 | 1175 | 1921 | 2239 |
| Downstream Effect | | | | | | |
| Lower Canyon | 270 | 261 | 86 | 78 | - | - |
| High Mountain Sheep | 180 | 179 | 57 | 54 | - | - |
| Downstream Effect Subtotal | 450 | 440 | 143 | 132 | - | - |
| Total | 1794 | 1767 | 1333 | 1307 | 1921 | 2239 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC 5/** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 783 | 765 | 638 | 618 | 1040 | 1232 |
| China Gardens | 185 | 218 | 149 | 176 | 236 | 300 |
| Downstream Effect | 205 | 204 | 57 | 54 | - | - |
| Total | 1173 | 1187 | 844 | 848 | 1276 | 1532 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 222 | 177 | 79 | 74 | 107 | 147 |
| High Mt. Sheep Without Lower Canyon | (399) | (403) | (410) | (385) | (538) | (560) |

1/ Without Canadian storage the period extends from Sept. 1, 1936 through April 30, 1937, except that data for High Mountain Sheep Project alone the critical period data are based on a 7-month period from Sept. 16, 1936 through April 15, 1937.

2/ WPPSS data are based on ULTIMATE INTEGRATED OPERATION. Data from Sheet 1 WPPSS Exhibit 293 have been adjusted to reflect inclusion of WPPSS China Gardens Project.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively.

4/ WPPSS data are based on end of January, 1937 and PNPC data are based on mid-January, 1937

5/ PNPC data for High Mountain Sheep Project including China Gardens are based on an installation of 7 units at the High Mountain Sheep Project.

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Table 2, Sheet 1 of 2

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[fol. 27333]

TABLE 2
INITIAL PERIOD
(Common Reach Projects Except Whitebird & Freedom, but Including China Gardens)
WITH CANADIAN STORAGE

Table 2 - Sheet 2 of 2
WITH Canadian Storage

| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1937 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 1022 | 994 | 1007 | 981 | 1609 | 1867 |
| China Gardens - Elev. 915 | - | 140 | - | 130 | - | 225 |
| China Gardens - Elev. 905 | 118 | - | 112 | - | 195 | - |
| Common Reach Subtotal | 1140 | 1134 | 1119 | 1111 | 1814 | 2092 |
| Downstream Effect | | | | | | |
| Nez Perce | 332 | 354 | 135 | 125 | - | - |
| Total | 1472 | 1488 | 1254 | 1236 | 1814 | 2092 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 365 | - | 381 | - | 632 |
| Lower Canyon - Mile 0.5 | 393 | - | 403 | - | 580 | - |
| High Mountain Sheep (Net) | 717 | 697 | 638 | 618 | 1105 | 1294 |
| China Gardens - Elev. 940 | - | 196 | - | 176 | - | 300 |
| China Gardens - Elev. 925 | 165 | - | 149 | - | 236 | - |
| Common Reach Subtotal | 1275 | 1258 | 1190 | 1175 | 1921 | 2226 |
| Downstream Effect | | | | | | |
| Lower Canyon | 240 | 232 | 86 | 78 | - | - |
| High Mountain Sheep | 160 | 159 | 57 | 54 | - | - |
| Downstream Effect Subtotal | 400 | 391 | 143 | 132 | - | - |
| Total | 1675 | 1649 | 1333 | 1307 | 1921 | 2226 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC** 5/ | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 751 | 733 | 638 | 618 | 1040 | 1232 |
| China Gardens | 175 | 208 | 149 | 176 | 236 | 300 |
| Downstream Effect | 180 | 179 | 57 | 54 | - | - |
| Total | 1106 | 1120 | 844 | 848 | 1276 | 1532 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 203 | 161 | 79 | 71 | 107 | 134 |
| High Mt. Sheep Without Lower Canyon | (366) | (368) | (410) | (388) | (538) | (560) |

1/ With Canadian Storage which assumes during the initial period that 8,500,000 acre-feet have been developed at Arrow and Duncan Lakes, the critical period extends from August 1, 1936 through April 30, 1937 except that data for the High Mountain Sheep Project alone the critical period data are based on an 8-month period from Sept. 1, 1936 through April 30, 1937.

2/ WPPSS data are based on ULTIMATE INTEGRATED OPERATION. Data from Sheet 1 WPPSS Exhibit 293 have been adjusted to reflect inclusion of WPPSS China Gardens project.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively.

4/ WPPSS data are based on end of January, 1937 and PNPC data are based on mid-January, 1937.

5/ PNPC data for High Mountain Sheep project including China Gardens are based on an installation of 7 units at the High Mountain Sheep project.

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Table 2, Sheet 2 of 2

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[fol. 27334]

TABLE 3
SUBSEQUENT PERIOD - WITHOUT CREVICE STORAGE
(All Common Reach Projects)

Table 3 - Sheet 1 of 2
WITHOUT Canadian Storage

WITHOUT CANADIAN STORAGE

| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1932 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | 79 | 79 | 101 | 101 | 207 | 208 |
| Whitebird | 29 | 29 | 34 | 34 | 69 | 60 |
| Nez Perce (Net) | 820 | 770 | 1042 | 969 | 1874 | 1315 |
| China Gardens - Elev. 915 | - | 105 | - | 125 | - | 225 |
| China Gardens - Elev. 905 | 84 | - | 104 | - | 195 | - |
| Common Reach Subtotal | 1012 | 983 | 1281 | 1229 | 2345 | 1808 |
| Downstream Effect | | | | | | |
| Nez Perce | 75 | 164 | 32 | 62 | - | - |
| Total | 1087 | 1147 | 1313 | 1291 | 2345 | 1808 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS<br>High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | 80 | 79 | 99 | 100 | 207 | 208 |
| Lower Canyon - Mile 3.7 | - | 309 | - | 401 | - | 423 |
| Lower Canyon - Mile 0.5 | 344 | - | 436 | - | 805 | - |
| High Mountain Sheep (Net) | 495 | 491 | 610 | 584 | 1200 | 956 |
| China Gardens - Elev. 940 | - | 143 | - | 169 | - | 300 |
| China Gardens - Elev. 925 | 115 | - | 137 | - | 236 | - |
| Common Reach Subtotal | 1034 | 1022 | 1282 | 1254 | 2448 | 1887 |
| Downstream Effect | | | | | | |
| Lower Canyon | 54 | 107 | 16 | 47 | - | - |
| High Mountain Sheep | 20 | 74 | 15 | 19 | - | - |
| Downstream Effect Subtotal | 74 | 181 | 31 | 66 | - | - |
| Total | 1108 | 1203 | 1313 | 1320 | 2448 | 1887 |
| **High Mountain Sheep Plan - WPPSS<br>Project No. 2443 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 495 | 491 | 610 | 584 | 1200 | 956 |
| China Gardens | 115 | 143 | 137 | 169 | 236 | 300 |
| Downstream Effect | 20 | 74 | 15 | 19 | - | - |
| Total | 630 | 708 | 762 | 772 | 1436 | 1256 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 21 | 56 | 0 | 29 | 103 | 79 |
| High Mt. Sheep Without Lower Canyon | (457) | (439) | (551) | (519) | (909) | (552) |

1/ Without Canadian Storage the critical period extends 31 months from August, 1929 through February, 1932.

2/ WPPSS data are taken from Sheet 2 of WPPSS Exhibit 293 except for the average energy generation at the Lower Canyon Project. The 436 MW figure is taken from testimony, Tr. pages 13461 to 13466.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively, except Freedom and Whitebird data. These latter data were computed by PNPC to reflect the power production for the projects under natural flow conditions.

4/ WPPSS data are based on end of January, 1932 and PNPC data are based on mid-January, 1932.

TABLE 3
SUBSEQUENT PERIOD - WITHOUT CREVICE STORAGE
(All Common Reach Projects)

WITH CANADIAN STORAGE

Table 3 - Sheet 2 of 2
WITH Canadian Storage

| | Nominal Prime Energy Avg. MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1932 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | 84 | 84 | 101 | 101 | 207 | 208 |
| Whitebird | 30 | 30 | 34 | 34 | 69 | 60 |
| Nez Perce (Net) | 858 | 821 | 1042 | 987 | 1874 | 1333 |
| China Gardens - Elev. 915 | - | 106 | - | 123 | - | 225 |
| China Gardens - Elev. 905 | 87 | - | 104 | - | 195 | - |
| Common Reach Subtotal | 1059 | 1041 | 1281 | 1245 | 2345 | 1826 |
| Downstream Effect | | | | | | |
| Nez Perce | 54 | 118 | 32 | 41 | - | - |
| Total | 1113 | 1159 | 1313 | 1286 | 2345 | 1826 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | 84 | 84 | 99 | 100 | 207 | 208 |
| Lower Canyon - Mile 3.7 | - | 333 | - | 411 | - | 356 |
| Lower Canyon - Mile 0.5 | 359 | - | 436 | - | 805 | - |
| High Mountain Sheep (Net) | 513 | 513 | 610 | 593 | 1200 | 1014 |
| China Gardens - Elev. 940 | - | 145 | - | 168 | - | 300 |
| China Gardens - Elev. 925 | 118 | - | 137 | - | 236 | - |
| Common Reach Subtotal | 1074 | 1075 | 1282 | 1272 | 2448 | 1878 |
| Downstream Effect | | | | | | |
| Lower Canyon | 39 | 77 | 16 | 34 | - | - |
| High Mountain Sheep | 14 | 53 | 15 | 10 | - | - |
| Downstream Effect Subtotal | 53 | 130 | 31 | 44 | - | - |
| Total | 1127 | 1205 | 1313 | 1316 | 2448 | 1878 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 512 | 513 | 610 | 593 | 1200 | 1014 |
| China Gardens | 118 | 145 | 137 | 168 | 236 | 300 |
| Downstream Effect | 14 | 53 | 15 | 10 | - | - |
| Total | 644 | 711 | 762 | 771 | 1436 | 1314 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 14 | 46 | 0 | 30 | 103 | 52 |
| High Mt. Sheep Without Lower Canyon | (469) | (448) | (551) | (515) | (909) | (512) |

1/ With Canadian Storage the critical period extends 43 months from August, 1928 through February, 1932.

2/ WPPSS data are taken from Sheet 2 of WPPSS Exhibit 293 except for the average energy generation at the Lower Canyon project. The 436 MW figure is taken from testimony, Tr. pages 13461 to 13466.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively, except Freedom and Whitebird data. These latter data were computed by PNPC to reflect the power production for the projects under natural flow conditions.

4/ WPPSS data are based on end of January, 1932 and PNPC data are based on mid-January, 1932.

[fol. 27336]

TABLE 4
SUBSEQUENT PERIOD - WITH CREVICE STORAGE
(All Common Reach Projects)
WITHOUT CANADIAN STORAGE

Table 4 - Sheet 1 of 2
WITHOUT Canadian Storage

| | Nominal Prime Energy Avg Mw Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | 113 | 113 | 136 | 148 | 207 | 520 |
| Whitebird | 43 | 48 | 49 | 58 | 80 | 180 |
| Nez Perce (Net) | 872 | 887 | 1067 | 1035 | 1874 | 2470 |
| China Gardens - Elev. 915 | - | 109 | - | 126 | - | 375 |
| China Gardens - Elev. 905 | 89 | - | 107 | - | 195 | - |
| Common Reach Subtotal | 1117 | 1,157 | 1359 | 1367 | 2356 | 3545 |
| Downstream Effect | | | | | | |
| Nez Perce | 75 | 145 | 32 | 19 | - | - |
| Total | 1192 | 1,302 | 1391 | 1386 | 2356 | 3545 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS<br>High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | 114 | 115 | 135 | 147 | 207 | 520 |
| Lower Canyon - Mile 3.7 | - | 400 | - | 459 | - | 1000 |
| Lower Canyon - Mile 0.5 | 403 | - | 472 | - | 805 | - |
| High Mountain Sheep (Net) | 495 | 508 | 610 | 591 | 1200 | 1536 |
| China Gardens - Elev. 940 | - | 149 | - | 171 | - | 500 |
| China Gardens - Elev. 925 | 118 | - | 140 | - | 236 | - |
| Common Reach Subtotal | 1130 | 1,172 | 1357 | 1368 | 2448 | 3556 |
| Downstream Effect | | | | | | |
| Lower Canyon | 54 | 87 | 16 | 11 | - | - |
| High Mountain Sheep | 20 | 67 | 15 | 9 | - | - |
| Downstream Effect Subtotal | 74 | 154 | 31 | 20 | - | - |
| Total | 1204 | 1,326 | 1388 | 1388 | 2448 | 3556 |
| **High Mountain Sheep Plan - WPPSS<br>Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 495 | 508 | 610 | 591 | 1200 | 1536 |
| China Gardens | 115 | 149 | 137 | 171 | 236 | 500 |
| Downstream Effect | 20 | 67 | 15 | 9 | - | - |
| Total | 630 | 724 | 762 | 771 | 1436 | 2036 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 12 | 24 | (3) | 2 | 92 | 11 |
| High Mt. Sheep Without Lower Canyon | (562) | (578) | (629) | (615) | (920) | (1509) |

1/ Without Canadian Storage the critical period extends 31 months from August, 1929 through February, 1932.

2/ WPPSS data are taken from sheet 2 of WPPSS Exhibit 293.

3/ PNPC data were computed to reflect the 31 month critical hydro period.

4/ WPPSS data are based on end of January, 1932. PNPC data are in accordance with PNPC Exhibit 82 and testimony relating thereto.

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Table 4, Sheet 1 of 2

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TABLE 4
SUBSEQUENT PERIOD - WITH CREVICE STORAGE
(All Common Reach Projects)
WITH CANADIAN STORAGE

Table 4 - Sheet 2 of 2
WITH Canadian Storage

| | Nominal Prime Energy Avg MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | 116 | 116 | 136 | 148 | 207 | 520 |
| Whitebird | 43 | 49 | 49 | 58 | 80 | 180 |
| Nez Perce (Net) | 892 | 896 | 1067 | 1035 | 1874 | 2470 |
| China Gardens - Elev. 915 | - | 110 | - | 126 | - | 375 |
| China Gardens - Elev. 905 | 91 | - | 107 | - | 195 | - |
| Common Reach Subtotal | 1142 | 1171 | 1359 | 1367 | 2356 | 3545 |
| Downstream Effect | | | | | | |
| Nez Perce | 54 | 104 | 32 | 19 | - | - |
| Total | 1196 | 1275 | 1391 | 1386 | 2356 | 3545 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | 117 | 118 | 135 | 147 | 207 | 520 |
| Lower Canyon - Mile 3.7 | - | 398 | - | 459 | | 1000 |
| Lower Canyon - Mile 0.5 | 407 | - | 472 | - | 895 | - |
| High Mountain Sheep (Net) | 512 | 517 | 610 | 591 | 1200 | 1536 |
| China Gardens - Elev. 940 | - | 150 | - | 171 | - | 500 |
| China Gardens - Elev. 925 | 120 | - | 140 | - | 236 | - |
| Common Reach Subtotal | 1156 | 1183 | 1357 | 1368 | 2448 | 3556 |
| Downstream Effect | | | | | | |
| Lower Canyon | 39 | 63 | 16 | 11 | - | - |
| High Mountain Sheep | 14 | 48 | 15 | 9 | - | - |
| Downstream Effect Subtotal | 53 | 111 | 31 | 20 | - | - |
| Total | 1209 | 1294 | 1388 | 1388 | 2448 | 3556 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 512 | 517 | 610 | 591 | 1200 | 1536 |
| China Gardens | 118 | 150 | 137 | 171 | 236 | 500 |
| Downstream Effect | 14 | 48 | 15 | 9 | - | - |
| Total | 644 | 715 | 762 | 771 | 1436 | 2036 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 13 | 19 | (3) | 2 | 92 | 11 |
| High Mt. Sheep Without Lower Canyon | (552) | (560) | (629) | (615) | (920) | (1509) |

1/ With Canadian Storage the critical period extends 43 months from August, 1928 thrugh February, 1932.

2/ WPPSS data are taken from Sheet 2 of WPPSS Exhibit 293.

3/ PNPC data are taken from PNPC Exhibit 82.

4/ WPPSS data are based on end of January, 1932. PNPC data are in accordance with PNPC Exhibit 82 and testimony relating thereto.

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Table 4, Sheet 2 of 2

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TABLE 5
SUBSEQUENT PERIOD WITHOUT CREVICE STORAGE
(Common Reach Projects Except Freedom and Whitebird)
WITHOUT CANADIAN STORAGE

Table 5 - Sheet 1 of 2
WITHOUT Canadian Storage

| | Nominal Prime Energy Avg Mw Critical Hydro Period 1/ | | Avg. Energy Generation Avg Mw 20 Years (1928 - 1948) | | Plant Peak Capability Mw January, 1932 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 820 | 770 | 1042 | 969 | 1874 | 1315 |
| China Gardens - Elev. 915 | - | 105 | - | 125 | - | 225 |
| China Gardens - Elev. 905 | 84 | - | 104 | - | 195 | - |
| Common Reach Subtotal | 904 | 875 | 1146 | 1094 | 2069 | 1540 |
| Downstream Effect | | | | | | |
| Nez Perce | 75 | 164 | 32 | 62 | - | - |
| Total | 979 | 1039 | 1178 | 1156 | 2069 | 1540 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** | | | | | | |
| **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 309 | - | 401 | - | 423 |
| Lower Canyon - Mile 0.5 | 344 | - | 436 | - | 805 | - |
| High Mountain Sheep (Net) | 495 | 491 | 610 | 584 | 1200 | 956 |
| China Gardens - Elev. 940 | - | 143 | - | 169 | - | 300 |
| China Gardens - Elev. 925 | 115 | - | 137 | - | 236 | - |
| Common Reach Subtotal | 954 | 943 | 1183 | 1154 | 2241 | 1679 |
| Downstream Effect | | | | | | |
| Lower Canyon | 54 | 107 | 16 | 47 | - | - |
| High Mountain Sheep | 20 | 74 | 15 | 19 | - | - |
| Downstream Effect Subtotal | 74 | 181 | 31 | 66 | - | - |
| Total | 1028 | 1124 | 1214 | 1220 | 2241 | 1679 |
| **High Mountain Sheep Plan - WPPSS** | | | | | | |
| **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 495 | 491 | 610 | 584 | 1200 | 956 |
| China Gardens | 115 | 143 | 137 | 169 | 236 | 300 |
| Downstream Effect | 20 | 74 | 15 | 19 | - | - |
| Total | 630 | 708 | 762 | 772 | 1436 | 1256 |
| **Difference: Nez Perce Plan To:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 49 | 85 | 36 | 64 | 172 | 139 |
| High Mt. Sheep Without Lower Canyon | (349) | (331) | (416) | (384) | (633) | (284) |

1/ Without Canadian Storage the critical period extends 31 months from August, 1929 through February, 1932.

2/ WPPSS data are taken from Sheet 2 of WPPSS Exhibit 293 by adjusting for elimination of Freedom and Whitebird Projects, and changing Lower Canyon average annual generation to 436 MW as taken from testimony, Tr. pages 13461 to 13466.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for Without and With Canadian Storage, respectively.

4/ WPPSS data are based on end of January, 1932 and PNPC data are based on mid-January, 1932.

TABLE 5
SUBSEQUENT PERIOD WITHOUT CREVICE STORAGE
(Common Reach Projects Except Freedom and Whitebird)
WITH CANADIAN STORAGE

Table 5 - Sheet 2 of 2
WITH Canadian Storage

| | Nominal Prime Energy Avg. MW Critical Hydro Period 1/ | | Avg. Energy Generation Avg. MW 20 Years (1928 - 1948) | | Plant Peak Capability MW January, 1932 4/ | |
|---|---|---|---|---|---|---|
| | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ | WPPSS Data 2/ | PNPC Data 3/ |
| **Nez Perce Plan - WPPSS & PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Whitebird | - | - | - | - | - | - |
| Nez Perce (Net) | 858 | 821 | 1042 | 987 | 1874 | 1333 |
| China Gardens - Elev. 915 | - | 106 | - | 123 | - | 225 |
| China Gardens - Elev. 905 | 87 | - | 104 | - | 195 | - |
| Common Reach Subtotal | 945 | 927 | 1146 | 1110 | 2069 | 1558 |
| Downstream Effect | | | | | | |
| Nez Perce | 54 | 118 | 32 | 41 | - | - |
| Total | 999 | 1045 | 1178 | 1151 | 2069 | 1558 |
| **High Mountain Sheep-Lower Canyon Plan - WPPSS** **High Mountain Sheep Plan - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| Lower Canyon - Mile 3.7 | - | 333 | - | 411 | - | 356 |
| Lower Canyon - Mile 0.5 | 359 | - | 436 | - | 805 | - |
| High Mountain Sheep (Net) | 513 | 513 | 610 | 593 | 1200 | 1014 |
| China Gardens - Elev. 940 | - | 145 | - | 168 | - | 300 |
| China Gardens - Elev. 925 | 118 | - | 137 | - | 236 | - |
| Common Reach Subtotal | 990 | 991 | 1183 | 1172 | 2241 | 1670 |
| Downstream Effect | | | | | | |
| Lower Canyon | 39 | 77 | 16 | 34 | - | - |
| High Mountain Sheep | 14 | 53 | 15 | 10 | - | - |
| Downstream Effect Subtotal | 53 | 130 | 31 | 44 | - | - |
| Total | 1043 | 1121 | 1214 | 1216 | 2241 | 1670 |
| **High Mountain Sheep Plan - WPPSS** **Project No. 2243 Application - PNPC** | | | | | | |
| Freedom | - | - | - | - | - | - |
| High Mountain Sheep (Net) | 512 | 513 | 610 | 593 | 1200 | 1014 |
| China Gardens | 118 | 145 | 137 | 168 | 236 | 300 |
| Downstream Effect | 14 | 53 | 15 | 10 | - | - |
| Total | 644 | 711 | 762 | 771 | 1436 | 1314 |
| **Difference: Nez Perce Plan to:** | | | | | | |
| High Mt. Sheep Including Lower Canyon | 44 | 76 | 36 | 65 | 172 | 112 |
| High Mt. Sheep Without Lower Canyon | (355) | (334) | (416) | (380) | (633) | (244) |

1/ With Canadian Storage the critical period extends 43 months from August, 1928 through February, 1932.

2/ WPPSS data are taken from Sheet 2 of WPPSS Exhibit 293 by adjusting for elimination of Freedom and Whitebird Projects, and changing Lower Canyon average annual generation to 436 MW as taken from testimony, Tr. pages 13461 to 13466.

3/ PNPC data are taken from PNPC Exhibits 81 and 82 for WITHOUT and WITH Canadian Storage, respectively.

4/ WPPSS data are based on end of January, 1932 and PNPC data are based on mid-January, 1932.

[fol. 27343] *Part J—Annual Power Benefits of Alternative Plans of Development*

Preparation of power routing studies and assignment of monetary values involve a series of judgments and assumptions that lead equally valid studies to different numerical conclusions. The parties agree that, taking these matters into consideration, the power outputs set forth in Tables 1-5 of Part I of this Joint Exhibit represent, for the purposes of comparative studies and under the conditions specified in each such table, annual benefits of the magnitudes shown on the accompanying table—Annual Power Benefits. In preparation of this table, the parties have used the following values:

$11.77 per kw of alternative thermal capacity (assigned to nominal prime energy divided by .9)

2.9 mills per kwh of average annual generation

$6.09 per kw of alternative hydro peaking (assigned to differential between nominal prime energy divided by .9 and January peak capability)

## ANNUAL POWER BENEFITS

(All figures $1000)

| Line | Plan | Tables 1 through 5 of Joint Statement Part I 1/ | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 2/ | 5 |
| | **WITHOUT CANADIAN STORAGE** | | | | | |
| 1 | Nez Perce Plan | 49,336 | 53,463 | 52,771 | 61,112 | 47,004 |
| 2 | High Mountain Sheep Plan Including Lower Canyon | 51,437 | 57,436 | 53,938 | 61,526 | 49,644 |
| 3 | Amount High Mountain Sheep Plan exceeds Nez Perce Plan | 2,101 | 3,973 | 1,167 | 414 | 2,640 |
| 4 | High Mountain Sheep Plan excluding Lower Canyon | 29,070 | 37,489 | 31,905 | 34,328 | 31,892 |
| 5 | Amount Nez Perce Plan exceeds High Mountain Sheep Plan excluding Lower Canyon | 20,266 | 15,974 | 20,866 | 26,784 | 15,112 |
| | **WITH CANADIAN STORAGE** | | | | | |
| 6 | Nez Perce Plan | 48,754 | 52,863 | 52,884 | 61,040 | 47,077 |
| 7 | High Mountain Sheep Plan including Lower Canyon | 50,764 | 56,649 | 53,925 | 61,441 | 49,604 |
| 8 | Amount High Mountain Sheep Plan exceeds Nez Perce Plan | 2,010 | 3,786 | 1,041 | 401 | 2,527 |
| 9 | High Mountain Sheep Plan excluding Lower Canyon | 28,814 | 37,066 | 32,123 | 34,333 | 32,123 |
| 10 | Amount Nez Perce Plan exceeds High Mountain Sheep Plan excluding Lower Canyon | 19,940 | 15,797 | 20,761 | 26,707 | 14,954 |

[fol. 27344]

1/ Reference is made to Tables 1 through 5 set forth in Joint Statement Part I giving power output data. Sheet 1 of the respective tables provides power output data WITHOUT Canadian Storage while Sheet 2 of these tables gives similar power output data WITH Canadian Storage.

Table identification is as follows:

Table 1 - Initial Period - Common Reach Projects except China Gardens, Whitebird and Freedom.

Table 2 - Initial Period - Common Reach Projects except Whitebird and Freedom.

Table 3 - Subsequent Period - All Common Reach Projects - No Crevice Storage.

Table 4 - Subsequent Period - All Common Reach Projects - With Crevice Storage.

Table 5 - Subsequent Period - Common Reach Projects except Freedom and Whitebird and excluding Crevice Storage.

2/ Data under this condition reflect the average figure based on WPPSS and PNPC plant Installations. PNPC installation reflects additional installation at all common reach projects while WPPSS data are based on initial installation. For the Nez Perce Plan, the range is from $57,219,000 (WPPSS) to $64,933,000 (PNPC); for High Mountain Sheep Plan including Lower Canyon, the range is from $57,783,000 (WPPSS) to $65,184,000 (PNPC); and for High Mountain Sheep Plan excluding Lower Canyon, the range is from $32,125,000 (WPPSS) to $36,536,000 (PNPC).

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[fol. 912]

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

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No. 18,728

WASHINGTON PUBLIC POWER SUPPLY SYSTEM, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., et al., STATE OF OREGON, et al., Intervenors.

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No. 18,729

DEPARTMENT OF CONSERVATION, STATE OF WASHINGTON, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., et al., STATE OF OREGON, et al., Intervenors.

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[fol. 913] No. 18,731

UNITED STATES OF AMERICA ON THE RELATION OF STEWART L. UDALL, Secretary of the Interior, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., et al., STATE OF OREGON, et al., Intervenors.

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Petitions to Review Orders of the Federal Power Commission

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*Mr. Northcutt Ely,* with whom *Messrs. C. Emerson Duncan, II, Jerome C. Muys, David B. Beers* and *Joseph H. Sharlitt* were on the brief, for petitioner in No. 18,728.

*Mr. S. Billingsley Hill,* Attorney, Department of Justice, with whom *Assistant Attorney General Clark* and *Mr. Roger P. Marquis,* Attorney, Department of Justice, were on the brief, for petitioner in No. 18,731.

*Mr. Peter H. Schiff,* Attorney, Federal Power Commission, with whom *Messrs. Richard A. Solomon,* General Counsel, *Howard E. Wahrenbrock,* Solicitor, and *Joel* [fol. 914] *Yohalem,* Attorney, Federal Power Commission, were on the brief, for respondent.

*Mr. Hugh Smith,* with whom *Mr. Richard M. Merriman* was on the brief, for intervenor, Pacific Northwest Power Company.

*Mr. Thomas J. Jones, III,* with whom *Mr. Peyton G. Bowman, III,* was on the brief, for intervenors, Idaho Public Utilities Commission and Idaho Fish and Game Commission.

*Mr. Charles B. Roe, Jr.*, submitted on the brief for petitioner in No. 18,729.

*Mr. John O. Graybeal*, with whom *Mr. C. Frank Reifsnyder* was on the brief for intervenor, Washington State Sportsmen's Council, Inc., and certain other intervenors.

*Messrs. Robert Y. Thornton* and *Lloyd G. Hamel* were on the brief for intervenor, State of Oregon.

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Before WILBUR K. MILLER, *Senior Circuit Judge*, and DANAHER and BURGER, *Circuit Judges*.

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OPINION—Decided March 24, 1966

WILBUR K. MILLER, *Senior Circuit Judge*:

*Nos. 18,728 and 18,729*

On June 26, 1964, Washington Public Power Supply System[1] and the Department of Conservation of the State of Washington filed with us separate petitions for review of an order of the Federal Power Commission dated Feb- [fol. 915] ruary 5, 1964, and an amendatory order dated April 30, 1964. For reasons set forth in the Commission's opinions, these orders, taken together, granted to Pacific Northwest Power Company, a privately owned corporation, and denied to the Power Supply System, a license to construct a hydroelectric project at the High Mountain Sheep dam site on the Snake River between Oregon and Idaho.

Both petitioners contended before the Commission, and contend here, that the Power Supply System, a municipality which on April 24, 1961, had applied for a license

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[1] The System is a joint operating agency composed of sixteen public utility districts of the State of Washington, organized to construct, acquire and operate facilities for the generation and transmission of electricity. It is a municipality within the meaning of Sections 3(7) and 7(a) of the Federal Power Act, 41 STAT. 1064, 1067, 16 U.S.C. §§ 796(7) and 800(a).

for a High Mountain Sheep project at the same site as that previously proposed by Pacific Northwest, was entitled to preference over Pacific Northwest under Section 7(a) of the Act, 16 U.S.C. § 800(a), which is in pertinent part as follows:

> "In issuing . . . licenses where no preliminary permit has been issued . . . the Commission shall give preference to applications therefor by States and municipalities, provided the plans for the same are deemed by the Commission equally well adapted, or shall within a reasonable time to be fixed by the Commission be made equally well adapted, to conserve and utilize in the public interest the water resources of the region . . . ."

This statutory provision undoubtedly gave the Public Power System preference over Pacific Northwest (provided its application met all requirements) if no preliminary permit had been issued.

Pacific Northwest insists that a preliminary permit had been issued to it, and was extant when it applied for the High Mountain Sheep license. On the other hand, the petitioners argue that Pacific Northwest's preliminary permit was limited to the Mountain Sheep and Pleasant Valley dam sites described in it and did not cover the High Mountain Sheep site. They further assert that Pacific Northwest's preliminary permit was terminated when the Commission declined to issue a license covering the sites therein [fol. 916] described. Thus, the controlling question before us is whether, in fact and in law, a preliminary permit covering the High Mountain Sheep site had been issued and was still valid when the Power Supply System applied for a license covering the same site. In other words, does the priority afforded by a preliminary permit apply only to a project for waterway development on the exact site described in the permit, or does it include a project on a

different site for developing essentially the same portion of the waterway, which is determined to be best adapted to comprehensive development of that waterway?"

The proceedings began on November 9, 1954, when Pacific Northwest filed with the Commission an application for a preliminary permit for a Mountain Sheep-Pleasant Valley project on the Snake River, which it described as two low dams on sites above the point where the Imnaha River empties into the Snake. The sites were 21 miles apart, the lower being only 3.7 miles above the High Mountain Sheep site now in controversy. The Commission issued a preliminary permit to Pacific Northwest April 8, 1955, to expire March 31, 1958. It designated the project as No. 2173 and described it as it had been described in the application.

On September 7, 1955, Pacific Northwest applied to the Commission for a license on the Mountain Sheep-Pleasant Valley project No. 2173, describing it in the terms used in the permit application and the preliminary permit. After a hearing, the Commission denied the application on January 28, 1958, on the ground that the plan proposed was not that best adapted to the development of the middle Snake River. It said:

> "It is readily apparent from the studies presented in House Document 531, in Senate Document No. 51, and from those prepared by the Staff for the Middle Snake Basin that any combination of projects which includes Nez Perce is consistently superior to any com- [fol. 917] bination of projects which does not include Nez Perce."

On March 31, 1958, the last day of its preliminary permit, Pacific Northwest filed an application for a license for the High Mountain Sheep project, which was docketed as No. 2243. The project was described as a single high dam at the High Mountain Sheep site instead of the two low dams originally contemplated at the Mountain Sheep and Pleas-

ant Valley sites. Nearly two years later, on March 15, 1960, the Power Supply System applied to the Commission for a Nez Perce project, designated as No. 2273. That site is below the mouth of the Salmon River and about three miles downstream from the High Mountain Sheep site.

We here reproduce a sketch of the reach of the Snake River involved in these cases, showing its tributaries and the various dam sites mentioned in this opinion.

The Commission consoliated the application of Pacific Northwest for the High Mountain Sheep site with that of the Power Supply System for the Nez Perce location and a hearing on the two applications was conducted by an examiner.[2] Before a determination had been made by him, the Power Supply System on April 24, 1961, moved to amend its Nez Perce license application and proposed as an alternative that, if the Commission no longer regarded the Nez Perce site as best adapted to comprehensive development of the Snake River, it should be licensed to construct a High Mountain Sheep project on the site proposed by Pacific Northwest more than three years before.

On February 5, 1964, the Commission departed from its

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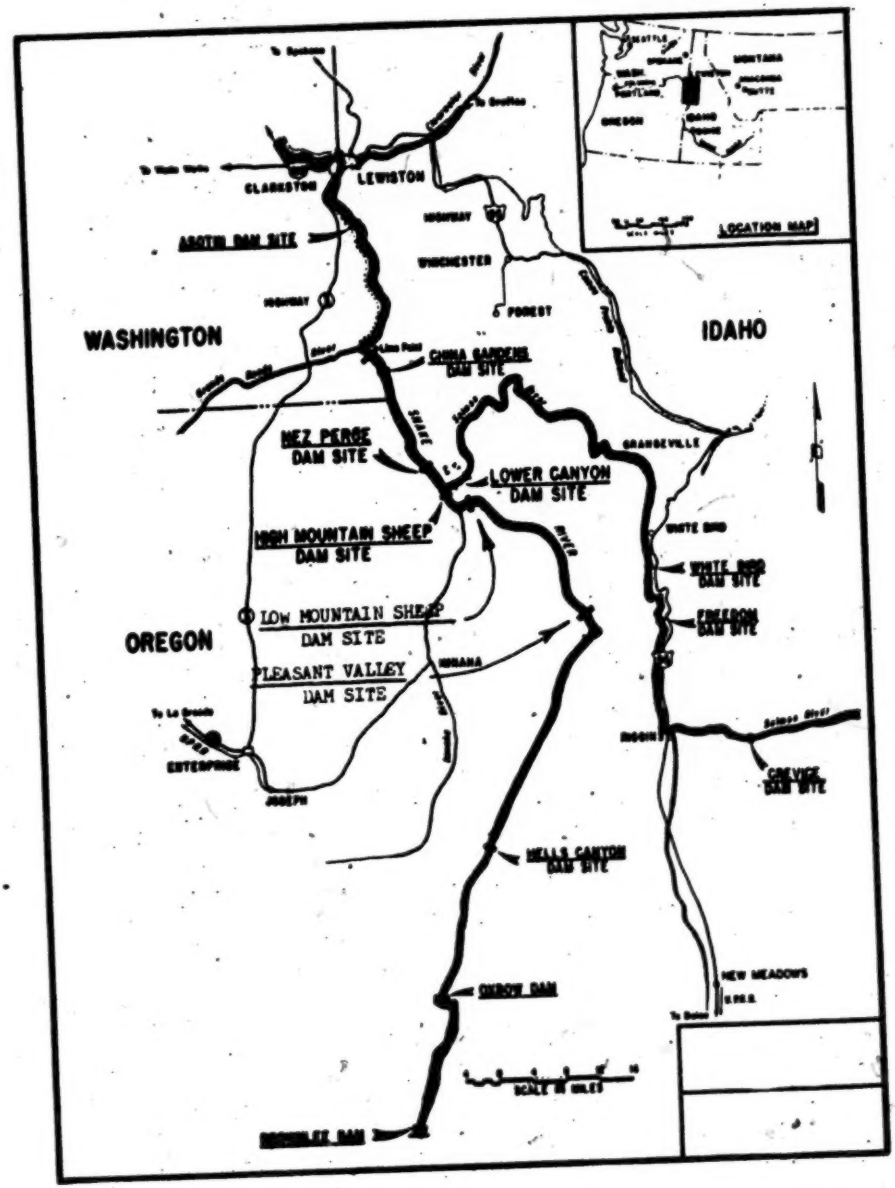
[2] The Secretary of the Interior intervened and asserted, *inter alia*, that a dam at the Nez Perce site, which is downstream from the mouth of the Salmon River, would interfere unduly with runs of anadromous fish up that stream.

[fol. 918]


LOCATION MAP
CLARKSTON
LEWISTON
ASOTIN DAM SITE
WINCHESTER
WASHINGTON
IDAHO
CHIEF JOSEPH DAM SITE
NEZ PERCE DAM SITE
LOWER CANYON DAM SITE
GRANDEVILLE
HIGH MOUNTAIN SHEEP DAM SITE
WHITE BIRD
WHITE BIRD DAM SITE
LOW MOUNTAIN SHEEP DAM SITE
FREEDOM DAM SITE
OREGON
PLEASANT VALLEY DAM SITE
ENTERPRISE
JOSEPH
GRAVIC DAM SITE
HELLS CANYON DAM SITE
CROW DAM
NEW MEADOWS
SCALE IN MILES
BROWNLEE DAM

[fol. 919] earlier dictum about the Nez Perce site and found that the High Mountain Sheep site was best adapted to a comprehensive plan for developing the Snake and Salmon Rivers because its location above the mouth of the Salmon eliminated the adverse effect on runs of anadromous fish in the Salmon River which probably would be caused by a Nez Perce dam below the Salmon's mouth. As to the conflicting applications, the Commission sustained its examiner's holding that the Power Supply System's application for a license for the High Mountain Sheep site was not entitled to preference, under Section 7(a) of the Act, over the earlier application of Pacific Northwest because the preference applies only where no preliminary permit has been issued.[3]

The legal question whether Pacific Northwest's preliminary permit was limited to the particular sites proposed in its application therefor, or was broad enough to cover the project on another site which was found by the Commission to be best adapted to a comprehensive development of that reach of the Snake River, was answered by the Commission in its opinion. It refused to adopt the narrow conception of a preliminary permit contended for by our petitioners, and, as we have said, held that Pacific Northwest's permit gave it priority with respect to the High Mountain Sheep site.

In doing so, the Commission said, in part:

> "A preliminary permit is issued under Section 4(f) of the Act to enable an applicant for a license to make studies and gather data and at the same time under Section 5 to maintain its priority of application. Section 4(f) specifically states that the permits are to enable applicants to secure the data and perform the [fol. 920] acts required by Section 9. The latter re-

[3] It held that the preliminary permit issued to Pacific Northwest for Project 2173 entitled that company to preference under Section 5 of the Act, 16 U.S.C. § 798, with respect to the High Mountain Sheep site.

quires that each applicant submit to the Commission 'maps, plans, specifications and estimates of cost as may be required for a full understanding of the proposed project.' Section 5 refers to the permit as being for the sole purpose of maintaining priority for a period, not exceeding three years, 'for making examinations and surveys, for preparing maps, plans, specifications, and estimates, and for making financial arrangements.' The statute limits the purpose of the permit to priority to avoid any interpretation that it represents permission to begin construction. The statute does not prevent but clearly contemplates that proposals and plans made at the time the permit was issued may be changed as a result of investigations made by the permittee. At the same time the permittee is protected by the permit from rival applicants while incurring expenses in the investigation of a project intended and required by Section 10(a), to be best adapted to a comprehensive development of the reach of the river involved.

"We consider it evident that the statutory intent of these provisions is to give a permittee the first rights to develop that reach of a river to which the permit relates. Any other interpretation would make the permit meaningless, for if another party could obtain a permit or apply for a license for a nearby project that would develop substantially the same head as the one described in the original permit, there would be no protection to the first permittee. . . . ".

The Commission also said in discussing the question:

"To interpret the priority afforded by a permit as limited to a single project would also be contrary to the two most significant objectives of the Act, namely, to encourage the development of our nation's water resources, and to insure that such development would be best adapted to the fullest use of the river, con-

sidering all uses. Who would be willing to undertake substantial and expensive investigations looking toward development of a river if a permit were good only in the event—the unlikely event—that the results of the investigations coincided precisely with the per- [fol. 921] mittee's guesstimate at the time the permit application was filed? In this connection, it is the experience of the Commission that a project is rarely constructed at the same exact site and in the same fashion as originally contemplated. Indeed, we are unaware of a single instance where this is true. . . . "

Where an administrative agency must and does initially determine the specific application of a statutory provision, as the Commission has done in these cases, the reviewing court's function is limited to deciding whether the administrative interpretation has "'warrant in the record' and a reasonable basis in law." *Labor Board* v. *Hearst Publications*, 322 U. S. 111, 131 (1944); *California Company* v. *Udall*, 111 U. S. App. D. C. 262, 296 F. (2d) 384 (1961). See also in *I.C.C.* v. *J-T Transport*, 368 U. S. 81 (1961), Mr. Justice Frankfurter's dissent, which was joined by Mr. Justice Harlan and Mr. Justice Stewart. In the dissent, at page 127, it was said:

"Administrative agencies are not only vested with discretion in sifting evidence and in making findings but may also draw on their specialized competence for ascertaining the reach and meaning of statutory language. Compare *Social Security Board* v. *Nierotko*, 327 U. S. 358, 368-371, with *Labor Board* v. *Hearst Publications*, 322 U. S. 111, 128-131. The factors to be considered on judicial review of such an administrative determination include the precision of the statutory language, the technical complexity of the relevant issues, the need for certainty as against experimentation, and the likelihood that Congress foresaw the

> precise question at issue and desired to express a foreclosing judgment on it. . . ."

This was not contradicted by the majority opinion, and we regard it as an apt, and because of its source a cogent, statement of the principle contained in it.

We hold that, measured by the guidelines of these cases, the Commission had the authority and the duty to interpret the priority provision in the first instance, and its interpretation should be affirmed unless it is unreasonable as [fol. 922] a matter of law or clearly contrary to congressional policy. That the Commission's priority determination does not offend in these respects is apparent, we think, from an examination of pertinent provisions of the Federal Power Act.

Section 4(e) of the Act, 16 U.S.C. § 797(e), authorizes and empowers the Commission to issue licenses

> " . . . for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several States . . . ."

Realizing that in many instances applications for such licenses cannot be prepared in final form without prior investigation of available sites, which may be and often is costly and time-consuming, Congress also authorized and empowered the Commission in Section 4(f) of the Act, 16 U.S.C. § 797(f), to issue preliminary permits for the purpose of enabling applicants to secure the data and perform the acts required by Section 9, 16 U.S.C. § 802: such

maps, plans, specifications and estimates of cost as may be required for a full understanding of the proposed project; and satisfactory evidence of compliance with the applicable laws of any state involved.

Section 5 of the Act, 16 U.S.C. § 798, provides that each such preliminary permit

> "... shall be for the sole purpose of maintaining priority of application for a license under the terms of this Act for such period or periods, not exceeding a total of three years, as in the discretion of the Commission may be necessary for making examinations and surveys, for preparing maps, plans, specifications, and estimates, and for making financial arrangements. [fol. 923] Each such permit shall set forth the conditions under which priority shall be maintained. Such permits shall not be transferable, and may be canceled by order of the Commission upon failure of permittees to comply with the conditions thereof or for other good cause shown after notice and opportunity for hearing."

Section 10(a) of the Act, 16 U.S.C. § 802(a), requires that all licenses shall be on condition

> "[t]hat the project adopted, including the maps, plans, and specifications, shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, and for other beneficial public uses, including recreational purposes; and if necessary in order to secure such plan the Commission shall have authority to require the modification of any project and of the plans and specifications of the project works before approval."

Obviously, the purpose of Sections 4(f) and 5 is to afford protection to the entrepreneur willing to invest his time and money in determining exactly where and in what form to propose construction of a project which will be best adapted to a comprehensive plan for improving or developing a waterway and the improvement and utilization of water-power development. It would be manifestly unfair to one who has expended large sums of money over a long period of time in the necessary investigation if, upon completion and subsequent application for a license, a state or municipality could step in and reap the fruit of his labors by obtaining a license for the site so laboriously determined upon, merely because of the preference granted by Section 7(a). It was to prevent such unfairness that Congress provided for preliminary permits which would maintain priority, and also provided that the preference granted to public bodies by Section 7(a) should not prevail over them.

[fol. 924] The petitioners' primary position that Pacific Northwest's preliminary permit which described two low dams in the Mountain Sheep-Pleasant Valley project was limited to exactly that project is almost tantamount to a contention that a preliminary permit is substantially equivalent to a license, that is to say, that a license can be granted only for the project described in the permit. In so contending, the petitioners ignore the command of Section 10(a) that the project as finally approved and adopted "shall be such as *in the judgment of the Commission* will be best adapted to a comprehensive plan for improving or developing a waterway . . . [and] for the improvement and utilization of water-power development . . . ." (Emphasis added.) Obviously, the Commission is charged with implementing the policies of the Act. It is entitled to such flexibility as will conform to the statutory objectives. The Supreme Court has pointed out as much in *Civil Aero. Bd.* v. *State Airlines*, 338 U. S. 572, 577-578 (1950). See also *Federal Com. Comm'n* v. *Broadcasting Co.*, 309 U. S. 134, 142-143 (1940).

It is further contended by the petitioners that the Commission's denial of Pacific Northwest's application for a license for the Mountain Sheep-Pleasant Valley dam sites terminated its preliminary permit as of the date of the denial January 28, 1958. We reject the contention. Under Section 5 of the Act, the Commission may cancel a preliminary permit "upon failure of permittees to comply with the conditions thereof or for other good cause shown *after notice and opportunity for hearing.*" (Emphasis added.) The Commission did not order cancellation of Pacific Northwest's preliminary permit when the Mountain Sheep-Pleasant Valley license application was denied but, as its subsequent actions showed, regarded the permit as thereafter in full vigor.

Moreover, the finality of the project description in the preliminary permit, which is the nub of petitioners' argu- [fol. 925] ment, is negated not only by the fact that the Commission's primary concern is in the development of waterways and water-power, as Congress directed in Section 10(a), but also by that section's concluding clause, which shows that the projects to achieve that development are not confined to those first suggested by an applicant:

> "... [A]nd if necessary in order to secure such plan the Commission shall have authority to require the modification of any project and of the plans and specifications of the project works before approval."

We hold therefore that the Commission's action here is not unreasonable as a matter of law and not clearly contrary to congressional policy but, on the contrary, was authorized by its governing statute. The orders under review will be upheld.

*Affirmed.*

*No. 18,731*

The Secretary of the Interior's petition for review of the same two orders of the Federal Power Commission challenges the action of the Commission in refusing to recommend that the High Mountain Sheep project be constructed and operated by the United States.

He asserts (a) that Congress has preempted the High Mountain Sheep site "in its comprehensive plan for regulating the flow of the waters of the Columbia River system;" and (b) that the Federal Power Act forbids the Commission to license for private development a project that will affect existing or planned federal development of water resources. The Secretary of the Interior also asserts (c) that "the Commission erred in failing to require an independent staff study and to permit the Secretary to offer evidence respecting federal development."

With respect to the Secretary's assertion (a), referred to in the preceding paragraph of this opinion, we need do [fol. 926] no more than cite the *Roanoke Rapids* case,[4] in which the Supreme Court rejected a similar argument. Section 7(b) of the Act, 16 U.S.C. § 800(b) commits solely to the Commission the task of deciding whether the development of any water resources for public purposes should be undertaken by the United States itself. Unless the Commission's action is arbitrary—without basis in the record—we have no power to disturb it. We think in this case the Commission was amply justified in refusing to recommend federal development and in issuing a license for private construction.

The Secretary's broad assertion (b), outlined above, cannot be sustained. It would, if literally accepted, mean that the existence of one federal dam in a waterway would require that any future dams therein be federally constructed. Manifestly, there is no such requirement: the

[4] United States *ex rel.* Chapman v. Federal Power Comm'n, 345 U.S. 153 (1953).

Snake River itself is already developed by a mixture of federal and non-federal projects. If the Commission had found that private development of the project would have a significant adverse effect on existing or planned federal projects, it might justifiably have recommended, under Section 7(b),[5] that federal construction be undertaken, even though Congress has not pre-empted the site. There [fol. 927] is no such finding here, however, and we find nothing in the record to justify that conclusion.

The Secretary's assertion (c), summarized above, is rejected. Suffice it to say that his long delay in opposing the grant to Pacific Northwest—the hearing had been concluded for over a year and the examiner's decision had already been rendered when the Secretary finally moved to intervene—was sufficient to warrant denial of his motion.[6] Nevertheless, the Commission permitted intervention limited to the filing of exceptions to the examiner's decision and participation in oral argument before it. Various communications from the Secretary were admitted in evidence. In these circumstances, we think the Secretary has no cause to complain that he was not permitted to introduce evidence which he has not proffered or described.

*Affirmed.*

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[5] 16 U.S.C. § 800(b):

"(b) Whenever, in the judgment of the Commission, the development of any water resources for public purposes should be undertaken by the United States itself, the Commission shall not approve any application for any project affecting such development, but shall cause to be made such examinations, surveys, reports, plans, and estimates of the cost of the proposed development as it may find necessary, and shall submit its findings to Congress with such recommendations as it may find appropriate concerning such development."

[6] The Secretary of the Interior was more than once specifically invited to participate in the proceedings, but for a period of about two years did nothing.

[fol. 928]

IN THE UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 18,728

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., et al., STATE OF OREGON, et al., Intervenors.

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No. 18,729

DEPARTMENT OF CONSERVATION, STATE OF WASHINGTON, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., et al., STATE OF OREGON, et al., Intervenors.

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[File endorsement omitted]

No. 18,731

UNITED STATES OF AMERICA ON THE RELATION OF STEWART L. UDALL, Secretary of the Interior, Petitioner,

v.

FEDERAL POWER COMMISSION, Respondent,

PACIFIC NORTHWEST POWER COMPANY, IDAHO WILDLIFE FEDERATION, IDAHO PUBLIC UTILITIES COMMISSION, IDAHO FISH AND GAME COMMISSION, WASHINGTON STATE SPORTSMEN'S COUNCIL, INC., ET AL., STATE OF OREGON, ET AL., Intervenors.

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On Petitions to Review Orders of the Federal Power Commission.

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Before: Wilbur K. Miller, Senior Circuit Judge, and Danaher and Burger, Circuit Judges.

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JUDGMENT—March 24, 1966

These cases came on to be heard on the record from the Federal Power Commission, and were argued by counsel for petitioners in Nos. 18,728 and 18,731, and by counsel for respondent. Case No. 18,729 was submitted on the brief for petitioner.

On Consideration Whereof, it is ordered and adjudged by this court that the orders of the Federal Power Commission on review in these cases are hereby affirmed.

[fol. 932] Clerk's Certificate to foregoing transcript (omitted in printing).

[fol. 933]

SUPREME COURT OF THE UNITED STATES

No.....—October Term, 1966

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM, Petitioner,

vs.

FEDERAL POWER COMMISSION, et al.

---

ORDER EXTENDING TIME TO FILE PETITION FOR WRIT OF CERTIORARI—June 21, 1966

Upon Consideration of the application of counsel for petitioner,

It Is Ordered that the time for filing a petition for writ of certiorari in the above-entitled cause be, and the same is hereby, extended to and including August 21, 1966.

Earl Warren, Chief Justice of the United States.

Dated this 21st day of June, 1966.

[fol. 934]

SUPREME COURT OF THE UNITED STATES

No.....—October Term, 1966

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UNITED STATES, ex rel. UDALL, Petitioner,

vs.

FEDERAL POWER COMMISSION, et al.

---

ORDER EXTENDING TIME TO FILE PETITION FOR WRIT OF CERTIORARI—June 21, 1966

Upon Consideration of the application of counsel for petitioner,

It Is Ordered that the time for filing a petition for writ of certiorari in the above-entitled cause be, and the same is hereby, extended to and including August 21st, 1966.

Earl Warren, Chief Justice of the United States.

Dated this 21st day of June, 1966.

[fol. 935]

SUPREME COURT OF THE UNITED STATES

No. 462—October Term, 1966

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM, Petitioner,

v.

FEDERAL POWER COMMISSION, et al.

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ORDER ALLOWING CERTIORARI—November 7, 1966

The petition herein for a writ of certiorari to the United States Court of Appeals for the District of Columbia Circuit is granted. The case is placed on the summary calendar and set for oral argument immediately following No. 463.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

[fol. 936]

SUPREME COURT OF THE UNITED STATES

No. 463—October Term, 1966

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STEWART L. UDALL, Secretary of the Interior, Petitioner,

v.

FEDERAL POWER COMMISSION, et al.

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ORDER ALLOWING CERTIORARI—November 7, 1966

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